STATUS OF SIX FURBEARER POPULATIONS IN THE MOUNTAINS OF NORTHERN CALIFORNIA

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PREFACE

This is a progress report of a cooperative effort to gather information on furbearers in California. The major cooperators are the Forest Service, the California Department of Fish and Game, the National Park Service, and the University of California, Berkeley.

The initial task was preparation of a provisional list of the published literature on furbearers in California. This was completed in 1973 (see Newberry 1973). The second step was to gather the published and unpublished records of observations of the highest priority species of furbearers, the ringtail, marten, fisher, wolverine, river otter and red fox. It is this second step that is summarized herein. As a graduate project, Philip Schempf visited National Forests and National Park Service lands to gather observation records (Schempf 1977). In addition, trappers and naturalists have been interviewed, and we have reviewed the published accounts.

We present here a summary of the information on the distribution and abundance of these six species which has become available since Grinnell et al.(1937) published *Fur-bearing Mammals of California.*

This account is not complete. Some of the reasons are as follows:

1) Coverage of northern California was incomplete and uneven. National Forests and National Park lands received the most attention, other areas were included only as records were available.
2) This was a record gathering exercise; no new field surveys were made.
3) Most of the records are from observations, not from specimens. Accuracy of identification doubtless varied considerably among observers.
4) No records obtained after 1975 were included in this report, although new observations are being collected. For example, subsequent to our efforts, the California Department of Fish and Game has conducted new surveys of distribution and abundance of river otter and red fox (see Kirk 1975, and Gray 1975, 1977). These latest surveys include coverage of the Sacramento Valley, which was outside our area of emphasis.

Field study is the next step, and it is very much needed. We hope our efforts will stimulate field studies on the distribution and abundance of each of these six species. It is likely that each of these species is more numerous and widespread than the available records indicate, although doubtless there are areas where a species had been recorded, but is no longer present. Therefore, it is important that all carefully verified observations be reported for future use.

All of the individual records upon which this report is based, and a list of interview and information sources, will be available in a companion publication (Schempf and White 1978). Those who wish to have the specific locations and dates of sightings, and these other data, can write to me to request a copy.

We were assisted by a large number of individuals and agencies during these surveys. We extend our thanks to all, but we mention only a few here because of space limitations. The Forest Service, National Park Service, and the California Department of Fish and Game provided financial and logistical support without which the project would have been impossible. Especially helpful individuals were E. R. Schneegas, R. D. Nelson, D. J. Dunaway, O. L. Wallis, H. R. Leach, C. F. Yocom, A. S. Leopold, and W. Z. Lidicker, Jr. Nobu Asami typed numerous versions of the manuscript, G. M. Christman did the art work for the figures, and J. M. White drew the cover illustration.

Marshall White

INTRODUCTION

There has been little detailed study of furbears in California since Grinnell et al. (1937) completed their classical study *Furbearing Mammals of California.* Most subsequent publications have relied heavily on this work for distributional information. In the 40 years since publication of *Fur-bearing Mammals of California*, the human population of California has increased fourfold and land use has intensified to meet the needs of these people. An assessment of the status of the furbearers in California is long overdue to identify population distributions, trends, and problems so that these important species can be conserved and managed in this rapidly changing land.

A survey of existing information was conducted on the distribution and abundance of the ringtail (*Bassariscus astutus raptor* and *B. a. nevadensis),* marten *(Martes americana humboldtensis* and *M. a. sierrae),* fisher *(Martes pennanti pacifica),* wolverine *(Gulo luscus luteus),* river otter *(Lutra canadensis brevipilosus)* and the red fox *(Vulpes fulva necator)* of Hall and Kelson (1959). This group includes little-known furbearers of California that require special management.

It is not possible for this paper to be a definitive statement of the distribution and abundance of these furbearers. Instead it is only a contribution toward a comprehensive study of this neglected group of mammals. We have summarized the available data on these species. From the information presented here, an appraisal of their current status can be made. Hopefully, thorough field studies will be undertaken, which will provide data for formulation of sound management programs.

AREAS STUDIED

This study primarily covers the areas encompassed by the boundaries of 14 National Forests and 6 National Park units in the mountains of northern California (fig. 1). These include the Eldorado, Inyo, Klamath, Lassen, Mendocino, Modoc, Plumas, Sequoia, Shasta-Trinity, Sierra, Six Rivers, Stanislaus, and Tahoe National Forests, and that part of the Toiyabe National Forest in California. The National Park units surveyed are Lassen Volcanic, Redwood, Sequoia-Kings Canyon and Yosemite National Parks, Whiskeytown National Recreation Area and Lava Beds National Monument. Information for adjacent lands and for the balance of northern California also was gathered during this survey, but it is incomplete and does not represent as accurately the status of the furbearers in these other areas.

The major study area lies in the two roughly parallel mountain belts, the Coast and Cascade–Sierra Nevada ranges. The Coast Range runs through western California, rising from a narrow coastal plain to elevations approaching 7,000 feet. This range is broken near San Francisco Bay by the Sacramento–San Joaquin River drainage. The Cascades extend into California from Oregon and reach the Lassen Peak region. The Sierra Nevada continues southward from this area and reaches altitudes greater than 14,000 feet toward the south. These two belts are connected in the northern part of the state by the Klamath Mountain Province, formed mainly by the Trinity Mountains and the Salmon – Trinity Alps which rise to elevations of 9,000 feet.

Besides these mountainous areas, the Modoc Plateau and parts of the Central Valley also were included. The Modoc Plateau is located in the northeast corner of the state, east of the Cascade-Sierra Nevada range and west of the Warner Mountains. Its average elevation is about 4,000 feet. The Central Valley, between the two major mountain ranges, comprises nearly a third of the total area of the state. Elevations here range from below sea level up to 1,000 feet in the foothills of the surrounding mountains (Durrenberger 1965).

The climates of the areas covered vary as greatly as the topography. Precipitation ranges from above 80 inches a year on the North Coast to less than 12 inches a year on the east slope of the Sierra Nevada. In general, precipitation decreases from west to east and from north to south; it increases with elevation, and is greater on western and southern slopes than on northern and eastern exposures. Most of this precipitation occurs as winter rain and snow (Dale 1959).

The study areas include four major vegetation groups as specified by Munz (1959), the Oregonian, Californian, Sierran and Nevandan Biotic Provinces. The Oregonian Province is found along the coast, primarily north of San Francisco Bay. Redwood *(Sequoia sempervirens)* and Douglas-fir *(Pseudotsuga menziesii)* are typical tree species. The Californian Province is represented mainly in the Central Valley and its associated areas. The natural vegetation here is mostly grassland, with some chaparral and a few trees. The Sierran Biotic Province extends along the Sierra Nevada at moderate to high elevations. The alpine areas of California are included in this province. The Nevadan Province occurs along the eastern edge of the state where sage *(Artemisia spp.)* and junipers *(Juniperus spp.)* are the indicative species.

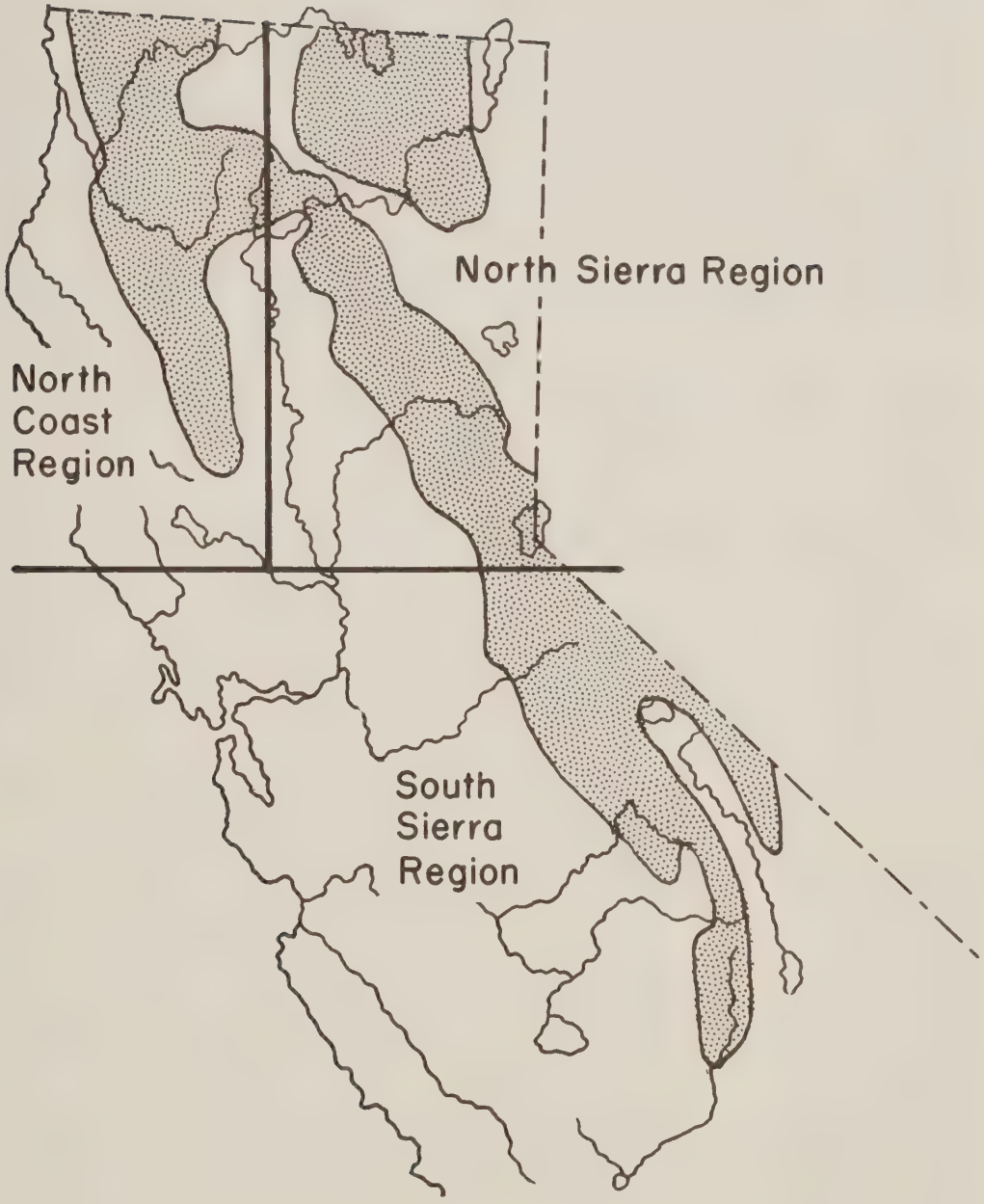

Figure 1. Stippled areas indicate the Forest and Park areas surveyed.

METHODS

Most of the base data were obtained from agency wildlife observation files. It is the policy of the Forest Service, the California Department of Fish and Game, and the National Park Service to keep records of noteworthy wildlife sightings. These sightings were collected, along with any additional written accounts or verbal information.

Knowledgeable residents of the surveyed areas also were contacted. This source revealed information of variable quality and reliability. Data obtained by these interviews were more general in nature, often indicating areas of known occurrence rather than specific sightings. Frequently, however, they furnished facts regarding population trends and habitat that were not otherwise available.

The literature was used to provide an historical perspective and for comparative habitat data. All published sightings not recorded by Grinnell et al. (1937) were sought to supplement the records gathered from the other sources.

A data card was filled out for each record. A specific location for each record was taken from Forest Service, National Park Service, or U.S. Geological Survey maps and then each record was plotted by species on distribution maps obtained from the Museum of Vertebrate Zoology. Different symbols were used to identify the location of the sightings and the approximate number of sightings at a location. In the figures, an open triangle represents a single observation made prior to 1960. An open circle represents a single observation made from 1960 to 1974. A solid triangle or circle represents 2 to 5 sightings for these time periods within a radius of 5 miles. If records of 2 to 5 sightings contain both pre-1960 and post-1960 sightings they are indicated as solid circles. The remaining symbol is a solid polygon, a rectangle in most cases. This represents a clumping of more than 5 sightings and can include both pre-1960 and post-1960 dates. The original maps and data cards used to construct them are on file with Marshall White at the University of California, Berkeley. See Schempf and White (1978) for lists of the records and sources.

The area studied was divided into 3 parts to detect regional variation in numbers, trends, or habitat preferences. These are the North Coast Region, the North Sierra Region and the South Sierra Region (fig.1). The North Coast Region is composed of Del Norte, Humboldt, Mendocino, Sonoma, Lake and Trinity counties and that part of Siskiyou County west of Range 5 West, M.D.M. The remainder of Siskiyou County along with Modoc, Shasta, Lassen, Tehama, Glenn, Butte, Plumas, Colusa, Yuba, Sutter, Sierra, Nevada and Placer counties form the North Sierra Region. The South Sierra Region includes Eldorado, Alpine, Amador, Calaveras, Tuolumne, Mono, Mariposa, Madera, Inyo, Fresno and Kern counties. Generally the North Coast Region encompasses the Coast Range, the North Sierra Region includes the northern part of the Central Valley and the Sierra to Lake Tahoe, and the South Sierra Region contains the Sierra south of Lake Tahoe. Although these subdivisions are based on political boundaries rather than on ecological ones, they have proven to be useful.

The elevation and vegetation types of each sighting location were estimated from maps to give a general indication of the habitat in which each species occurred. Elevations were determined from U.S. Geological Survey topographic maps, as accurately as the given location allowed, and were recorded to the nearest 100 feet. The average elevation, with standard deviation and range, were calculated for each species in each of the 3 regions and for the state as a whole. Histograms for each species illustrate these findings. The average is indicated as a horizontal line. A vertical rectangle indicates one standard deviation above and one below the average. The range is indicated by a horizontal line ending at the recorded elevation extreme (see figures).

Vegetation types were taken from the map of Wieslander and Jensen (1945). The percent occurrence of observations by vegetation type was calculated for each species, and illustrated by histograms. These vegetation types are defined as follows (adapted from Wieslander and Jensen 1946):

Mixed Confier: Mixtures of the timber pines *(Pinus* spp.*)* and either Douglas-fir or true firs *(Abies* spp.*)* in which the pines comprise from 20% to 80% of the timber cover. This type contains the giant sequoia *(Sequoiadendron giganteum)* groves of the Sierra Nevada.

Lodgepole Pine: With lodgepole *(Pinus murrayana),*whitebark *(P. albicaulis),* foxtail *(P. balfouriana),* limber *(P. flexilis),* or western white pine *(P. monticola)* or mountain hemlock *(Tsuga mertensiana),* either individually or in mixture, covering over 5% of the ground.

Fir: With true firs, either white *(A. concolor)* or red *(A. magnifica),*comprising over 80% of the timber cover.

Douglas-fir: With Douglas-fir comprising over 80% of the timber cover, or mixtures of Douglas-fir and true firs in which Douglas-fir comprises 20% or more of the timber cover.

Woodland: With hardwood trees such as oaks *(Quercus* spp.*)* and madrone *(Arbutus menziesii)* covering over 50% of the ground except where in mixture with herbaceous vegetation.

Pine: With ponderosa *(P. ponderosa),* Jeffrey *(P. jeffreyi)* or sugar pines *(P. lambertiana)* comprising over 80% of the timber cover.

Barren: Areas that are essentially devoid of vegetation.

Chaparral: With shrubs such as manzanitas *(Arctostaphylos* spp.*),* scrub oaks and chamise *(Adenostoma fasciculatum)* covering over 50% of the ground.

Woodland-grass: With hardwood trees and herbaceous vegetation occurring in mixture and the trees covering from 5% to 80% of the ground.

Miscellaneous: All other types.

RINGTAIL

The ringtail is well distributed over the state except for the deserts, the Central Valley, and at higher elevations in the mountains (Grinnell et al. 1937, Ingles 1965, fig. 2).

Vegetation types

Over much of its range the ringtail is associated with dry, rocky, brush-covered hillsides (Nelson 1918, Seton 1937). In northern California, however, it is also found in riparian areas with tree species such as madrone and tan oak *(Lithocarpus densiflora),* and with blue oak *(Quercus douglasii),* golden oak *(Quercus chrysolepis)* and digger pine *(Pinus sabiniana)* in the drier foothills of the Sierra (Grinnell et al. 1937, Sumner and Dixon 1953, Seymour 1968).

The data from the present study indicate that the ringtail in northern California is primarily found in the woodland type, with 31% of all sightings occurring here (fig. 3). Woodlands and woodland-grasslands are especially important in the North Coast Region; 65% of the records came from these 2 vegetation types. Hardwoods are less important in the Sierra where mixed conifer, chaparral and pine types increase in importance. Mixed conifer and chaparral are the dominant forms in the North Sierra Region, while woodland and mixed conifer are dominant in the South Sierra Region. These relationships may result from the drier conditions in the interior parts of the state which cause woodland species to be partially replaced by chaparral in marginal areas.

Elevational distribution

The ringtail is primarily a lowland animal. Grinnell et al. (1937) stated that it occurs from sea level up to 7,200 feet, with populations on the north coast occurring mainly below 3,000 feet and those in the southern parts of the state below 4,000 feet. The present data agree well with this for the most part (fig. 4). The lowest observation was at approximately 50 feet in the Butte Sink, Butte County. The highest, however, was on top of Half Dome, Yosemite National Park, at an elevation of 8,800 feet, which greatly exceeds the previous high noted at Glacier Point (Herschler 1929, Grinnell et al. 1937).

There is a gradual increase in elevation of the records from the North Coast through the North Sierra to the South Sierra, for the ringtail and for the other 5 species as well. In part, this reflects the general topographic features of these 3 arbitrarily designated regions: The frequency and extent of higher elevation lands increase from the North Coast to the North Sierra to the South Sierra. Additionally, similar habitats tend to occur at higher elevations as latitude decreases from north to south along the Sierra.

For the ringtail, the altitudinal averages are 1,900 in the North Coast, 2,800 in the North Sierra, and 3,900 feet in the South Sierra Region. While North Coast records fall within the range given in the literature, South Sierra observations are somewhat higher than expected.

North Coast Region

Few records were obtained from the counties adjoining the coast (fig. 2). Ringtails are listed as rare in Redwood National Park (Leach 1973). In the Mendocino National Forest, they are also listed as rare (USFS 1972), although 119 were trapped in the Mendocino National Forest in 1920 (Seton 1937) and trappers presently consider them common along the Eel River.

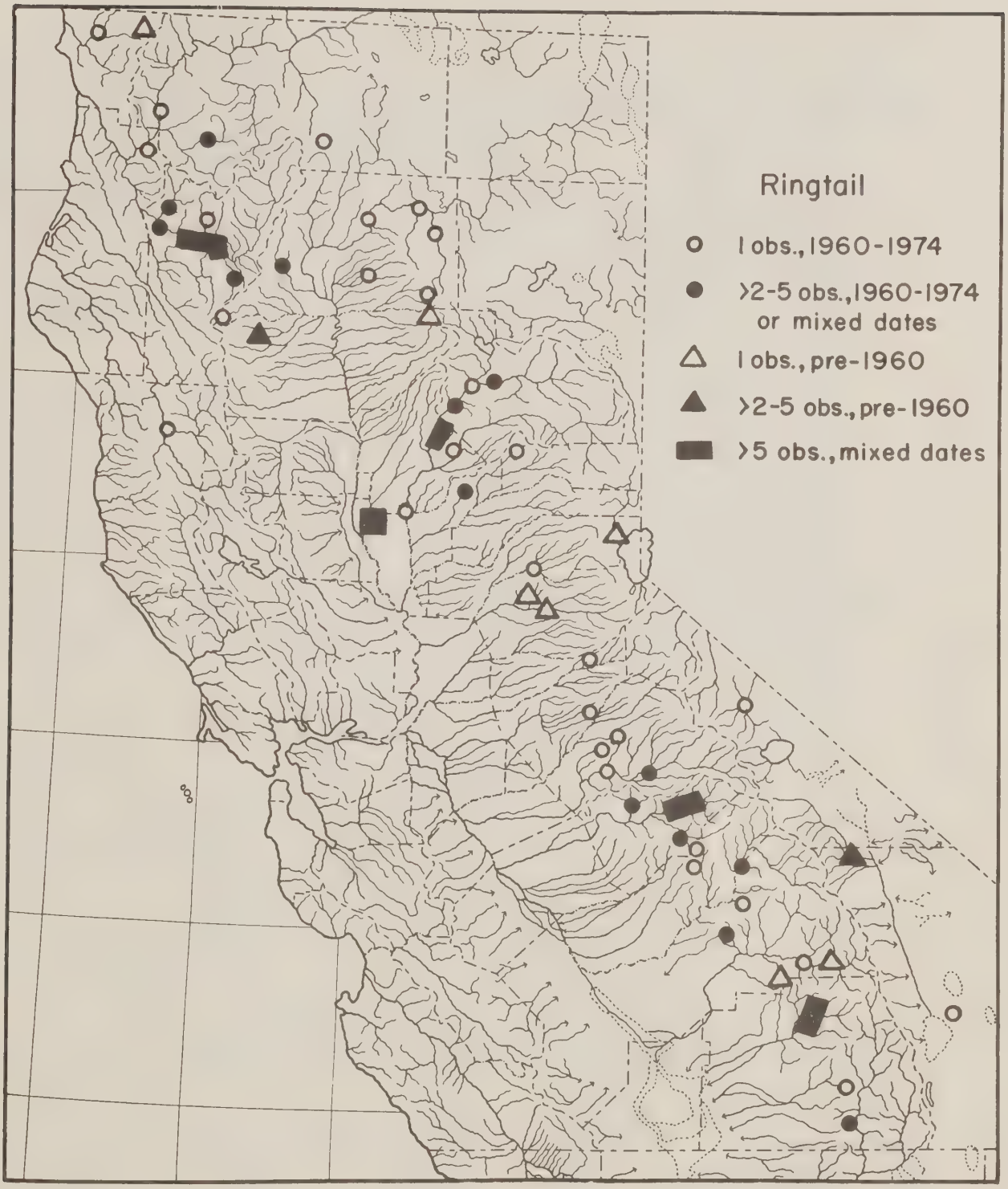

Figure 2. Distribution of ringtail reports.

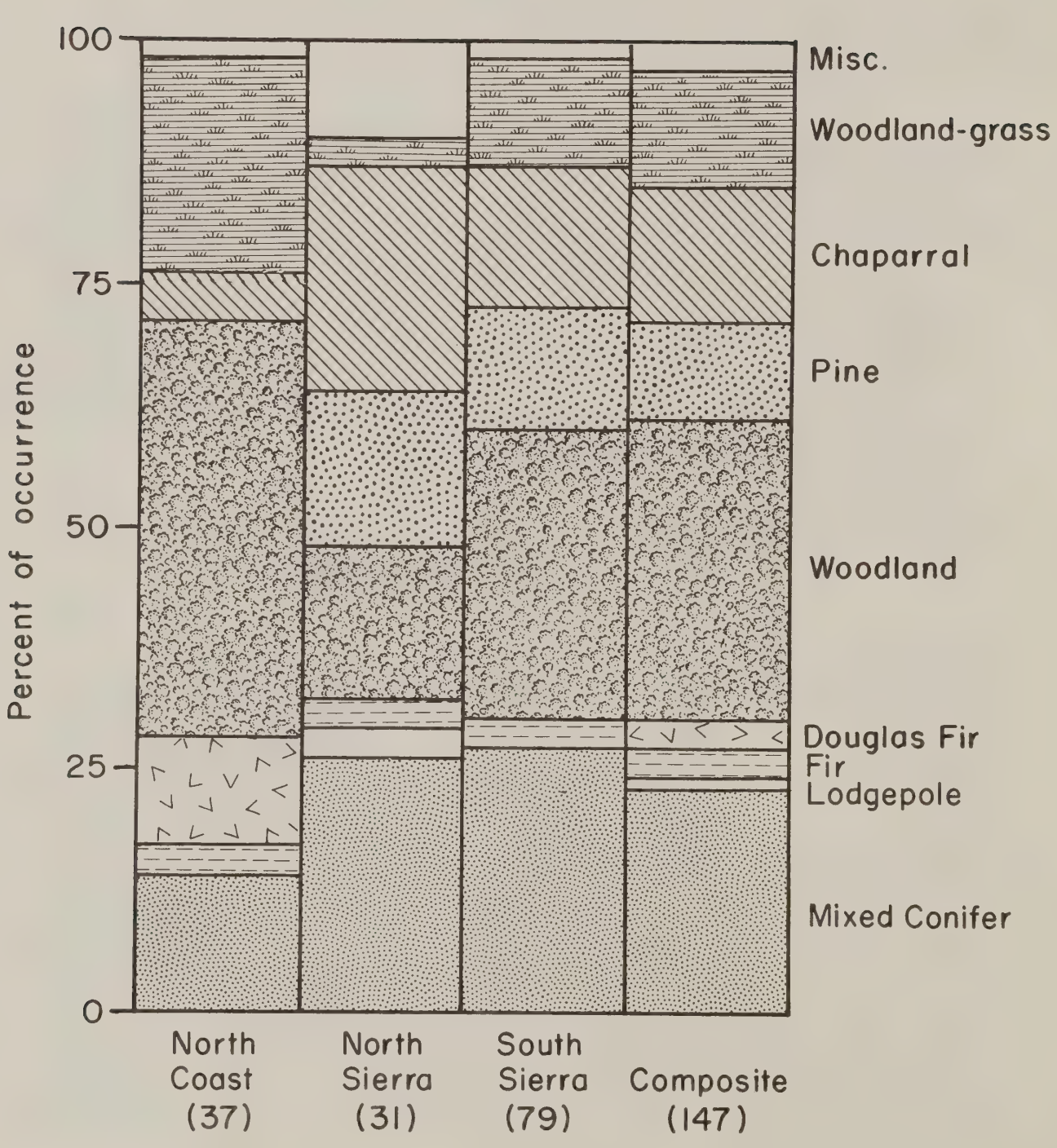

Figure 3. Percent occurrence of ringtail reports by vegetation type in three regions of California. Sample size in parentheses.

Numerous observations were recorded from Trinity County, particularly along the Trinity River from Junction City to Burnt Ranch (fig. 2). This concentration of sightings is in part the result of the thorough records kept by the Big Bar Ranger District. Ringtails probably are common in most drainages in the county. Discussions with Forest Service personnel and local residents support this conclusion.

Only 3 records were obtained from the western part of Siskiyou County, but information gathered from local residents indicates that ringtails are common along the Klamath and Salmon River drainages. M. Ryce of Sawyers Bar stated that they are common along the Klamath east of Happy Camp and along the Salmon near Sawyers Bar. E. Glaze also stated that he often had to remove traps set for coyote or bobcat along the Klamath River near Orleans to avoid trapping ringtails.

North Sierra Region

The distribution of sightings gathered from the North Sierra closely parallels the distribution indicated by Grinnell et al. (1937) with 2 exceptions. The first is in extreme northeastern Shasta County where the ringtail appears to be absent. During the winter of 1972-73, V. Cunningham caught 4 ringtails near Fall River Mills while trapping for bobcat. These were the first specimens he had observed in this area although he has been trapping here for some time. The other case is the occurrence of ringtails in Butte Sink and around Sutter Buttes in Butte and Sutter counties. This population was first mentioned in the literature in 1956 (Naylor and Wilson 1956). T. Stone and W. Frazier of the California Department of Fish and Game (CDFG) stated that ringtails still can be found here.

The ringtail is uncommon in the eastern part of Siskiyou County. Only one record was available, which indicated the presence of a colony at Black Butte Lookout just west of Mount Shasta. B. Benkosky also stated that he believes ringtails to be uncommon in the Mount Shasta area.

Ringtails are well distributed over the remainder of Shasta County and southward through the foothills of the Sierra, apparently in good numbers. The densest population in the North Sierra Region appeared to be in the Feather River Canyon, primarily from Belden to the Pulga area. It is likely that other west side drainages such as the Yuba also are inhabited by dense ringtail populations. No records were obtained from Modoc or Lassen counties or from the eastern portions of counties to the south.

South Sierra Region

Two subspecies of ringtail occur in the South Sierra Region, *Bassariscus astutus raptor* on the west slope of the Sierra and *B. a. nevadensis* in the Inyo Mountains. From the literature (Grinnell et al. 1937), and from these surveys, it appears that ringtails are numerous west of the Sierra, in the Inyo Mountains, and almost absent from the eastern slope of the Sierra. Currently ringtails can be found continuously along the South Sierra in the western foothills from Eldorado County to Tulare County. Ringtails were also noted to occur along the Kern River.

The concentration of sightings along the Merced and Kaweah rivers (fig. 2) probably is a result of detailed records kept by personnel of Yosemite and Sequoia-Kings Canyon National Parks. There is little reason to expect great variations in densities among comparable areas throughout the South Sierra foothills.

Grinnell et al. (1937) believed the range of *B. a. nevadensis* was east of the Owens River, chiefly in Inyo County. In 1939, however, 2 specimens were collected in Birchim Canyon west of Bishop, a considerable distance west of the indicated range. More recently,

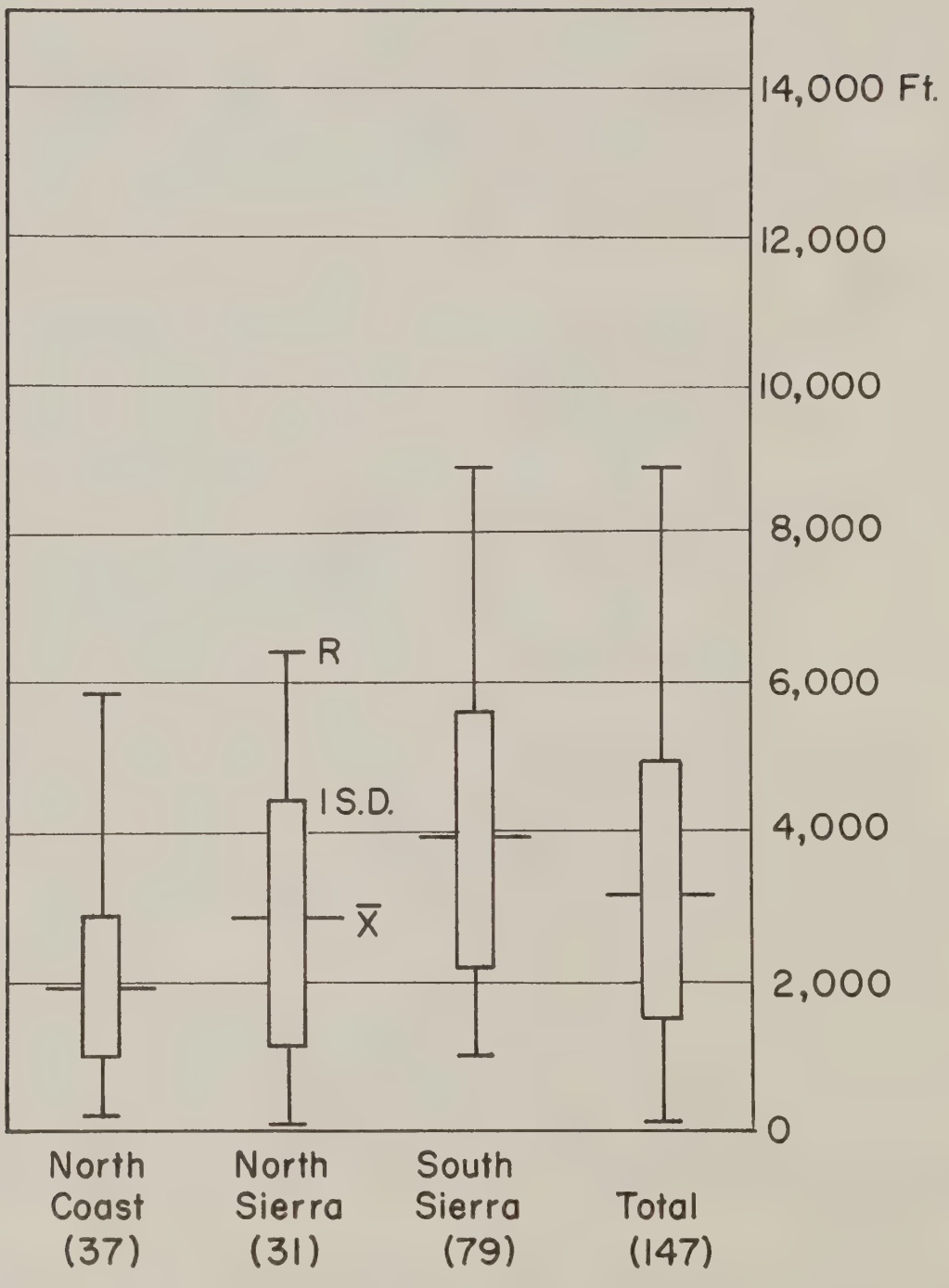

Figure 4. Elevational distribution of ringtail reports in three regions of California. Sample size in parentheses.

a road kill was reported in the Bridgeport area, Mono County (M. Hysell and M. Applegate, pers. comm.). The details of this report were sketchy, but the incident reportedly occurred within the past 5 years. It is possible that the ringtail has expanded its range east of the Sierra crest, but this cannot be substantiated by the present data. The only other report was from B. Curtis (CDFG), who indicated that ringtails occur between Cerro Gordo and Mexican Mine in the Inyo Mountains east of Owens Lake. This area is well within the previously described range.

Trends

In the late 1800's ringtails were considered rare by trappers in northern California (Townsend 1887), but they have become much more common in recent decades. Ringtail numbers (Table 1) and their range probably are increasing currently.

Table I

Number of ringtail reports in three regions of California in four time periods.

	Time period				
Region	Pre-1950	1950-1959	1960-1969	1970-1974	Total
North Coast	1	0	15	20	37[a]
North Sierra	3	1	17	10	31
South Sierra	26	8	18	23	79[b]
Total	30	9	50	53	147

[a] - one undated record

[b] - four undated records

MARTEN

Two races of marten occur in California, the Humboldt marten *(Martes americana humboldtensis)* and the Sierra Nevada marten *(M. a. sierrae).* The Humboldt marten is found in much of Del Norte, Humboldt, and Mendocino counties, and into the northwest corners of Lake and Sonoma counties. The recorded range of the Sierra Nevada marten covers most of Siskiyou and Shasta counties, and the northern half of Trinity County. The distribution then extends southward from this area through the Sierra Nevada to Kern County. Martens are indicated as absent in Modoc County, the Central Valley, and the White and Inyo mountains of Mono and Inyo counties (Grinnell et al. 1937, fig. 5). The recent reports given by Yocom (1974) fall within the ranges presumed by Grinnell et al. (1937).

Vegetation types

The Humboldt marten inhabits the North Coast forests (Grinnell 1933, Yocom and Dasmann 1965, Ingles 1965). Martens have been reported in redwood forests, but they are more common farther inland where redwoods give way to Douglas-fir, pines, and hardwoods (Grinnell et al. 1937).

The vegetation types where martens were recorded in this study in the North Coast Region correspond with those described in the literature. More than half of the records collected from the North Coast were in the mixed conifer type (fig. 6). Another 26% of the sightings occurred in Douglas-fir; only 1 of the 34 sightings occurred in the redwood type.

The literature indicates that the Sierra Nevada marten is closely associated with the red fir forests found in the higher mountains; it also frequents lodgepole pine and other conifer stands which occur at high elevations (Kellogg 1916, Orr 1949, Seymour 1968).

In the North Sierra Region the majority of the sightings occurred in the fir type. Lodgepole pine was of secondary importance. In the South Sierra Region, however, the importance of these 2 types was reversed. Barren areas were also of greater importance in the South. Comparisons of the vegetation of the North and South Sierra Regions on the map of Wieslander and Jensen (1945) show that fir is more prevalent in the North while lodgepole and barren areas are more frequent in the South. This change in vegetation is due mostly to the generally higher elevations of the South Sierra, which favor lodgepole and barren areas. Nevertheless, martens are found most frequently in the fir type in the North and the lodgepole type in the South.

The belief that martens require dense, uncut stands of mature conifers is widespread. There are many references to this in the literature (Merriam 1899, Kellogg 1916, Nelson 1918, Bailey 1936, Grinnell et al. 1937, Seton 1937, Orr 1949, Storer and Usinger 1963, Ingles 1965, Caras 1967, Seymour 1968). Many individuals contacted during the study also stated that this was true. The typical comment was that martens are most common where the timber is the thickest (B. Benkosky, V. Cunningham, P. Friday, L. Johnson, M. Ryce). J. Kahl stated that the areas with the most sightings on the Lassen National Forest were unlogged and without roads. V. Barandt (CDFG) of Lone Pine, Inyo County, also indicated that roads are detrimental to marten populations.

On the other hand, Coues (1877) noted that martens were particularly abundant in standing fire-killed forests. Two marten observations were recorded in old burns, one on 12 August 1950 in Lassen County, and one on 11 June 1965 in Nevada County. It has also been noted that timber production by clear cutting was positively correlated with pelt production of Russian sable, a close relative of the marten (Krasnovskii 1970). Martens have been recorded in the Great Basin sage type (Jones 1955a) and also in open areas above

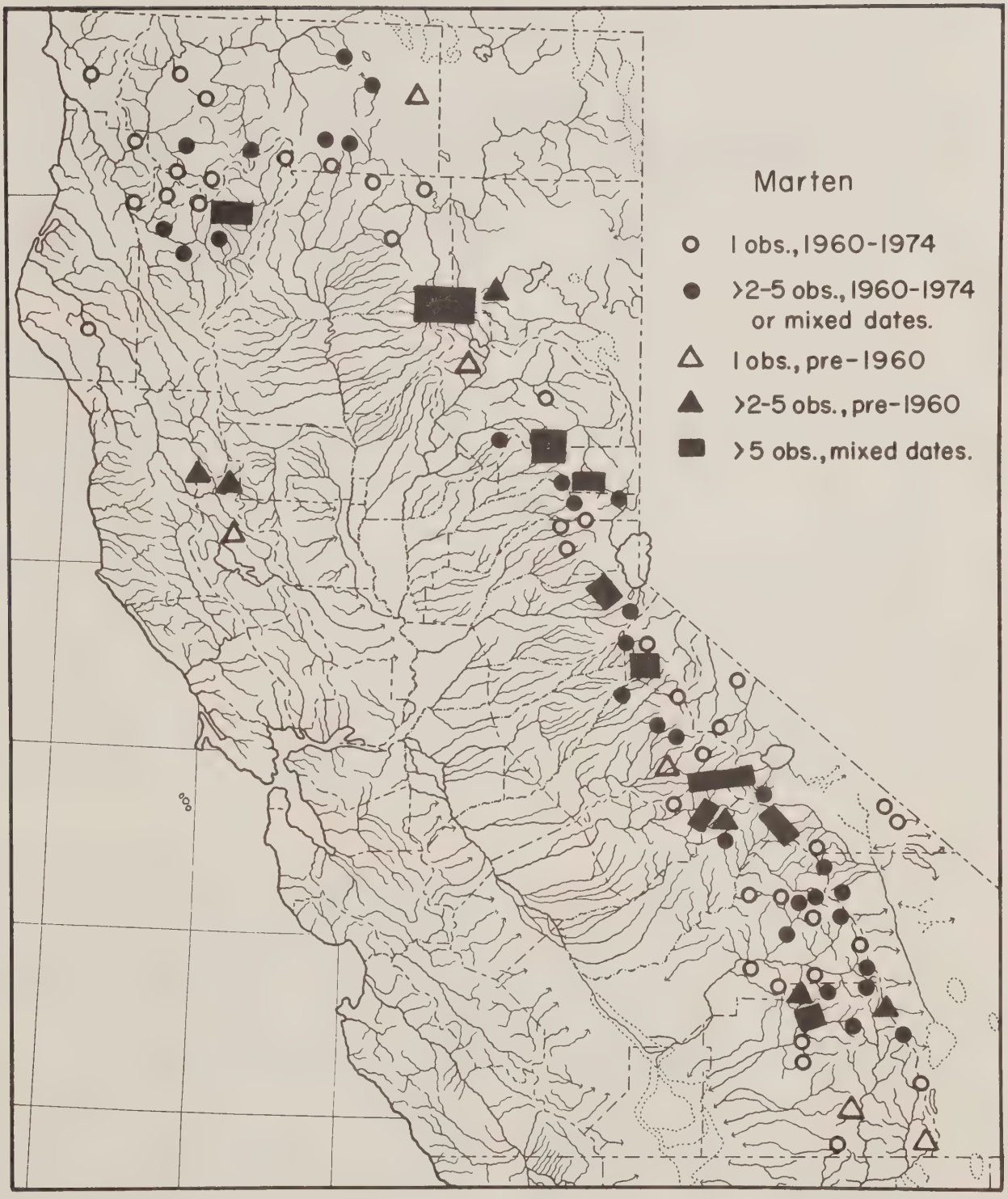

Figure 5. Distribution of marten reports.

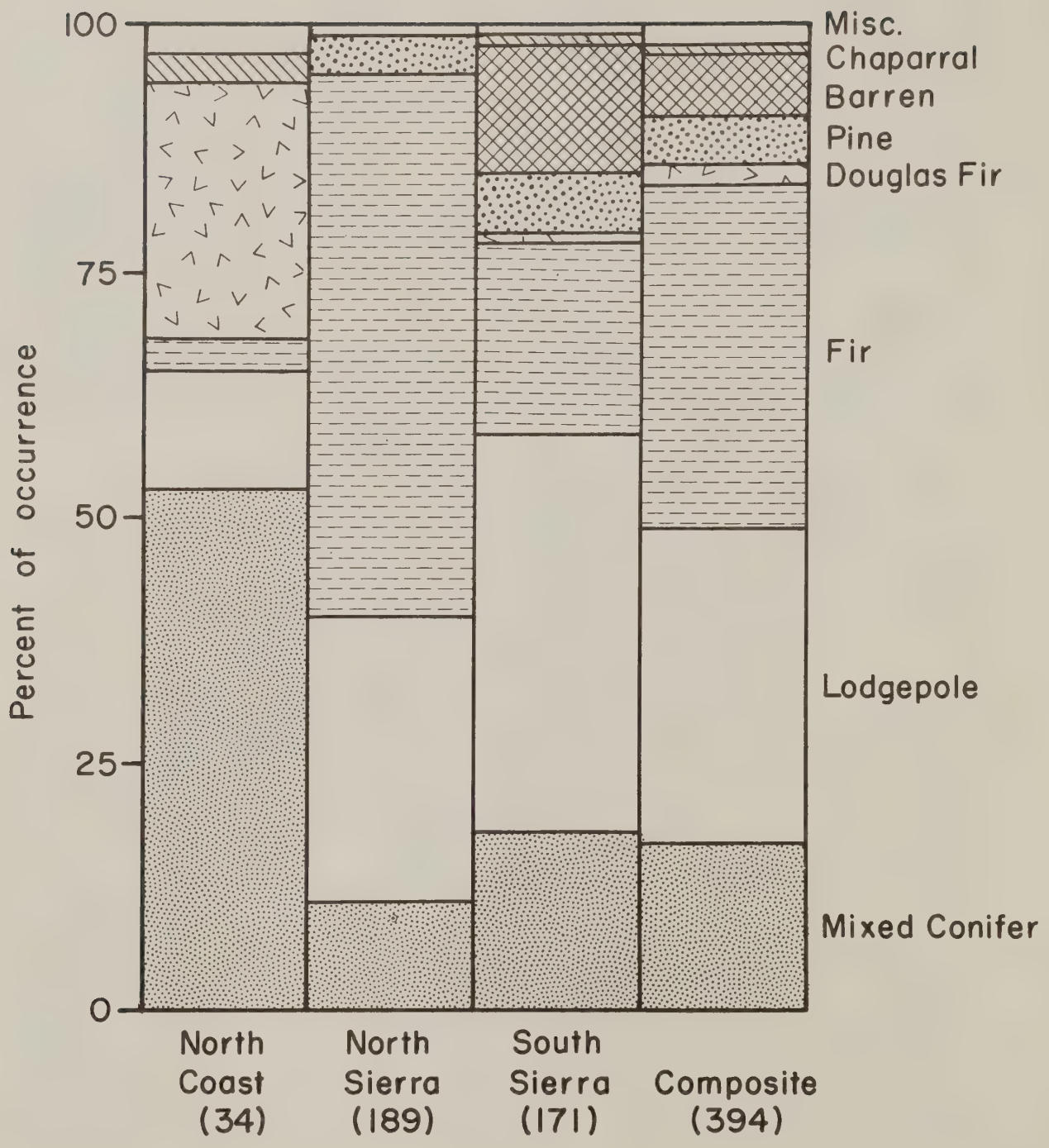

Figure 6. Percent occurrence of marten reports by vegetation type in three regions of California. Sample size in parentheses.

timber line (Streeter and Braun 1968). Six percent (25) of the sightings obtained during this study occurred above timber line on barren areas, and one sighting was recorded in the Great Basin sage type.

Obviously martens are not entirely restricted to either dense conifer forest or to open areas, but utilize both of these. Mature forest areas furnish shelter (Coues 1877, Grinnell et al. 1937, Seton 1937) and winter food such as hares and tree squirrels *(Tamiasciurus* and *Glaucomys).* Open areas are important foraging sites for mice *(Clethrionomys* and *Microtus),* chipmunks *(Eutamias),* pikas *(Ochotona)* and other small mammals, but these areas are used mostly when they are free of snow (Marshall 1946, Cowan and Mackay 1950, Lensink et al. 1955).

Elevational Distribution

The 2 races of martens are found at different elevations. According to the literature, Humboldt martens are found from sea level to 3,000 feet (Grinnell 1933). The lowest record for the Sierra Nevada marten was 4,000 feet near Weed, Siskiyou County, while the highest was 10,600 feet at Bullfrog Basin, Tulare County (Grinnell et al. 1937).

The lowest record found for the North Coast Region during this study was 200 feet in Humboldt Redwoods State Park, 0.5 mile south of Weott, Humboldt County. The highest record was 9,000 feet at North Emerald Lake, Trinity County. The average elevation of the 34 records obtained from the North Coast Region was 4,700 feet (fig. 7).

The elevational ranges for the North and South Sierra Region records agree generally with Grinnell et al. (1937), but tend to be somewhat higher. The lowest record in the North Sierra Region was at Thousand Springs near Dana, Shasta County, at an elevation of 3,400 feet, while the highest was 10,400 feet on Lassen Peak. The highest sighting recorded during this study in the South Sierra Region was 13,100 feet on Forester Pass, Tulare County, and the low was 4,000 feet on Oat Mountain, Fresno County. The averages for the North and South Sierra Regions were 6,600 feet and 8,300 feet, respectively.

North Coast Region

Martens of both the sierran and Humboldt subspecies are found in the North Coast Region; however, it is impossible to determine which subspecies was observed during any particular sighting. Therefore, the collected records indicate only the occurrence of the species and do not indicate the range of one race or the other.

The only location where the distribution indicated by this study differs from that ascribed to the marten by Grinnell et al. (1937) is in northern Lake County and the adjacent parts of Mendocino County (fig. 5). Stone (1904) first mentioned the presence of martens in the area near Mount Sanhedrin, but indicated that they occurred "sparingly." Twining and Hensley (1947) reported that the range of the marten extended over much of Mendocino County and the northern end of Lake County. The most recent record in this area was in 1950 when one was observed on Bartlett Mountain by a state trapper (Hemphill 1952). Although there have been no reports of martens here for many years, a remnant population is believed to still exist (Lorenzana 1972).

Martens occur in Mendocino, Humboldt and Del Norte counties. Yocom (1974) indicates 7 observations for these 3 counties, but none for Lake County. We obtained 9 records for the same area (fig. 5), but most of them were old. Martens occur in Redwood National Park, but they are rare (Leach 1973). Grinnell et al. (1937) stated that at one time martens were well distributed and fairly numerous in these coastal areas, but at the time of writing they were considered uncommon. This still appears to be the case.

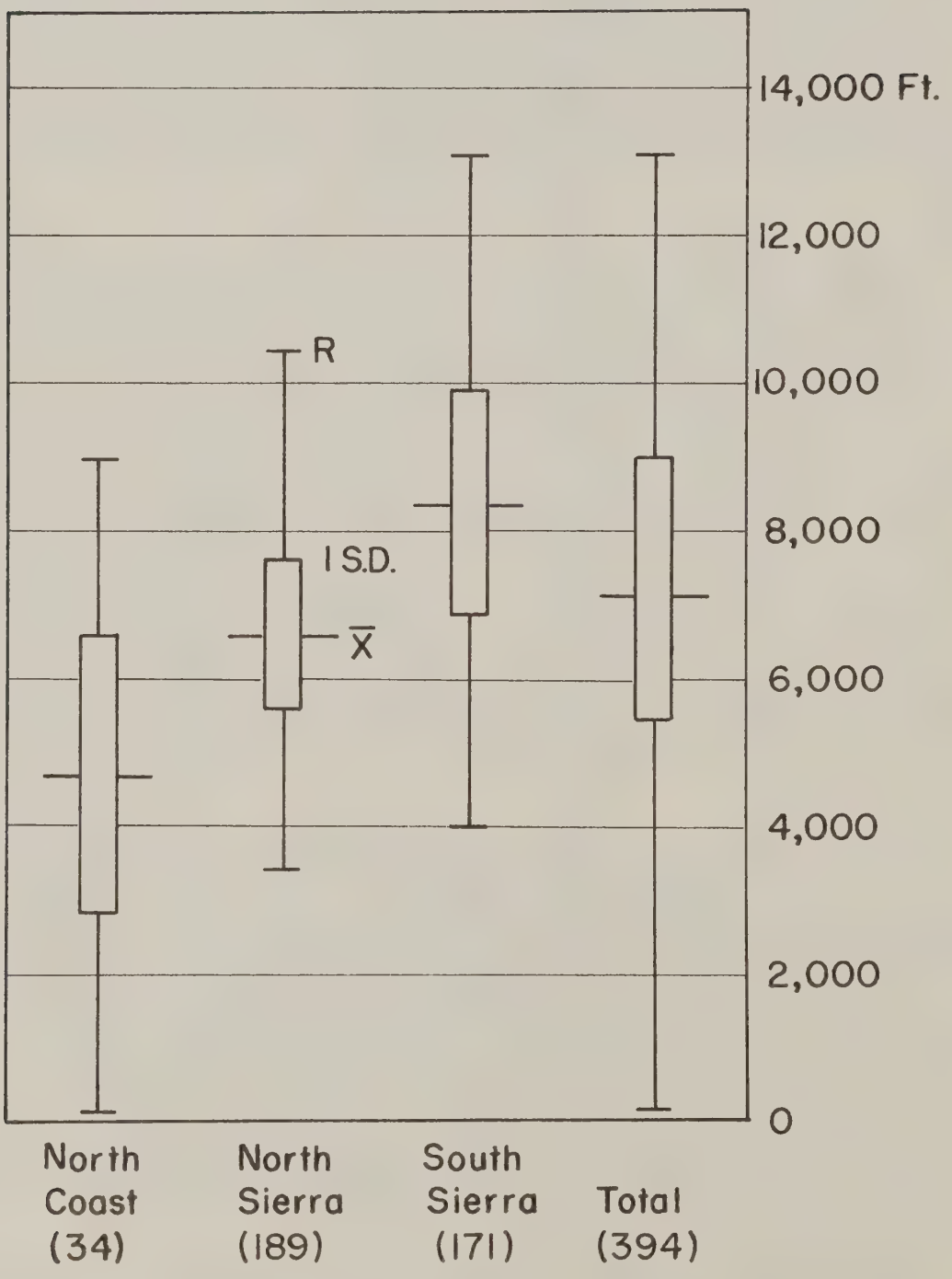

Figure 7. Elevational distribution of marten reports in three regions of California. Sample size in parentheses.

Trinity and Siskiyou counties give a different impression. Yocom (1974) indicates 7 records for Trinity County and the western portions of Siskiyou County. We found 17 and 8 records, respectively, for the same areas. All of these sightings have been recorded in the past decade. Yocom (1974) believes that marten numbers currently are increasing in this area and we agree.

North Sierra Region

Martens are much more numerous in the 2 Sierra regions than in the North Coast. In the North Sierra they are well distributed over the eastern parts of Siskiyou and Shasta counties and along the high Sierra to Lake Tahoe (fig. 5). Both Grinnell et al. (1937) and Twining and Hensley (1947) showed the range of the marten extending southward from Mount Shasta to Lake Shasta and beyond. It is likely that the range of the marten now follows the slopes of Mount Shasta, then continues eastward toward Burney Mountain and then southward through the Sierra.

More than 140 sightings were recorded for Lassen Volcanic National Park, which lies primarily in Shasta and Lassen counties. This area is relatively high in elevation and is blanketed mainly by a mature growth of red fir. Lassen Park represents excellent marten habitat. It also has offered complete protection from trapping since the park's creation. Both of these factors, and the Park Service record-keeping, contribute to the large number of sightings.

No records were obtained from the Warner Mountains in Modoc County. Grinnell et al. (1937) mentioned that martens had been reported, but they had no recent or "well-attested" records for the area. R. Ward (USFS) of Cedarville does not believe that martens inhabit the Warners. Observations indicate that there is suitable habitat in these mountains. Hall and Kelson (1959) also indicated that favored prey species such as squirrels, voles and pikas occur there. The reason for the absence of marten records from the Warner Mountains is unclear. A thorough search is in order.

Another good area for marten in the North Sierra Region is the Gold Lake–Webber Lake area in Sierra County. Grinnell et al. (1937) showed that many martens were trapped there, and we obtained 12 recent records from the area. Although the number of records is much lower than for Lassen Park, the numbers of martens present may be similar. The disparity may result more from lack of observers in Sierra County rather than from fewer martens.

South Sierra Region

Grinnell et al. (1937) indicated that the densest marten populations in the South Sierra occurred in the Tioga Pass–Mono Lake area, in the eastern end of Madera County, and the northeastern part of Fresno County. While we found many records from these areas, we also obtained similar numbers of records both to the south and to the north. Martens currently appear to be equally distributed from Eldorado County through Tulare County to the Kern County line.

Neither of the previous publications dealing with marten distribution in California has indicated its presence in the White Mountains of Mono County (Grinnell et al. 1937, Twining and Hensley 1947). Martens are listed as present in this area, however, in a check-list of mammals of the White Mountains (Hock 1963). T. Wenzel, from the University of California, Davis, stated that he had observed them near Indian and Perry Aiken creeks on the east slope of the White Mountians. He also reported that martens of the White Mountains are associated with bristlecone pine *(Pinus aristata).*

Several other marginal records are noteworthy. Martens are believed to occur in the Buckeye Creek drainage west of Bridgeport, Mono County (M. Hysell and M. Applegate). The other notable sightings are in southeastern Tulare County. V. Barandt (CDFG) of Lone Pine stated that he has seen martens at Summit Meadow, southwest of Olancha. This is only a short distance outside of the range presumed by Grinnell et al. (1937), but K. Wortley of Kernville stated that he observed a marten in the early 1930's at Chimney Meadow in the far southeastern corner of Tulare County. Chimney Meadow lies at 6,300 feet and is in an area covered primarily with pinyon *(Pinus monophylla).* All of the information gathered during this study and from the literature indicates that this is not typical marten habitat. The presence of marten in this area needs to be verified.

Trends

The great number of records obtained from the past 15 years, compared to the paucity of records prior to this, does not in itself reflect an increase in marten numbers. It may only show a lack of historical information. Knowledgeable observers believe, however, that marten numbers are increasing in both the North Coast and North Sierra Regions. Yocom (1974) believes that there has been an increase of martens in the high country of Siskiyou and Trinity counties in recent years. L. Johnson of Sierraville believes martens to be increasing in the high country of Sierra County. J. Foster of Quincy also believes martens are increasing in the Lassen Park area. There were no verbal or published reports of marten trends available for the South Sierra.

A continuous and uniform effort to observe and record the occurrence of martens in California would allow an assessment of their population trends. Unfortunately such an effort has not been made. The records of the older National Parks in California, however, are helpful. Park observations are not available for the North Coast Region. Records are available for the North Sierra from Lassen Volcanic National Park and for the South Sierra from Yosemite and Sequoia-Kings Canyon National Parks.

Records from Lassen prior to 1950 were not available, so only the period from 1950 to 1974 is considered. If this time span is roughly halved into sightings before 1963 and those from 1963 to 1974, an interesting coincidence is noted. Since 1950, 142 sightings from Lassen, 39 from Yosemite, and 60 from Sequoia-Kings have been recorded. Of these sightings, the recent observations (from 1963 to the present) formed 71%, 64% and 67% of the respective totals. Thus, there has been an almost parallel increase in sightings in these 3 areas during the past 25 years (adapted from Schempf and White 1974). This cannot be taken as conclusive evidence, but it strongly suggests that martens have increased throughout the Sierra during the last quarter-century.

FISHER

The literature shows that fishers reside in forested mountains of California north of the 35th parallel (Townsend 1887, Grinnell 1933, fig. 8). They occur from the northwest part of the state south through Trinity County to the Clear Lake area in Lake County and then probably southwestward to the coast in Sonoma and Marin counties. In the eastern part of the state, they can be found from Mount Shasta southward through the Sierra to Greenhorn Mountain in north-central Kern County. Fishers appear to be absent from most of Modoc, Lassen, Mono and Inyo counties and the Central Valley (Grinnell et al. 1937). The densest populations exist in Trinity, Tuolumne and Tulare counties (Ingles 1965, Seymour 1968).

While our study was in progress, a paper dealing with the status of fishers in northwestern California was published (Yocom and McCollum 1973). Many of the sources of information used for this publication were the same as those we have used. Records from the Yocom and McCollum (1973) publication are included in this account.

Vegetation types

The fisher is regarded as an inhabitant of the dense forest by many writers (Townsend 1887, Merriam 1899, Jotter 1918, Nelson 1918, Grinnell 1933, Bailey 1936, Ingles 1965, Caras 1967, Seymour 1968). However, Seton (1937) stated that they are not bound to the forest as martens are. They appear to prefer heavy timber, but they are frequently seen in open second-growth stands and occasionally in areas recently burned over (De Vos 1952, Hagmeier 1956). In British Columbia, fishers were noted to occur most abundantly in areas of relatively well-drained, semi-open mixed forest (Edwards and Cowan 1957). The vegetation types previously associated with the fisher in California are yellow pine *(Pinus ponderosa),* red fir and lodgepole pine forests (Storer and Usinger 1963, Ingles 1965).

The present analysis suggests that the fisher in California is most closely associated with the mixed conifer and Douglas-fir types (fig. 9). In the North Coast Region, 48% of 108 sightings occurred in Douglas-fir and another 38% were in mixed conifer types. In the South Sierra, fishers were found primarily in the mixed conifer type. The few records from the North Sierra imply an equal preference for the fir and lodgepole types in this region, but overall, these types were relatively unimportant. Pine was of moderate importance in the South Sierra; however, only 8% of the total sightings for the state were in this type.

Besides being found in these forested types, the fisher also occurs in more open areas. One was seen crossing Zeigler Point Road (Trinity Co.) in an area that had been clear-cut (Six Rivers National Forest files). One was seen in an area covered by grass, sage and scattered junipers southeast of Pittville, Lassen County (V. Cunningham). There were also 3 records of fishers in the chaparral type. This should not be construed to indicate that fishers do not need dense timber, but that they also use non-timbered areas. From the data herein collected it appears that fisher habitat in California is similar to that described in British Columbia by Edwards and Cowan (1957).

Elevational distribution

The fisher often occurs at somewhat lower altitudes than does the marten (Orr 1949, Ingles 1965, Seymour 1968). It lives between 2,000 feet and 5,000 feet in the Trinity Mountains in the North Coast Region and between 4,000 and 8,000 feet in the South Sierra (Grinnell et al. 1937). The highest observation previously recorded for this species was on Mount Lyell in Yosemite National Park at 10,900 feet (Grinnell 1933).

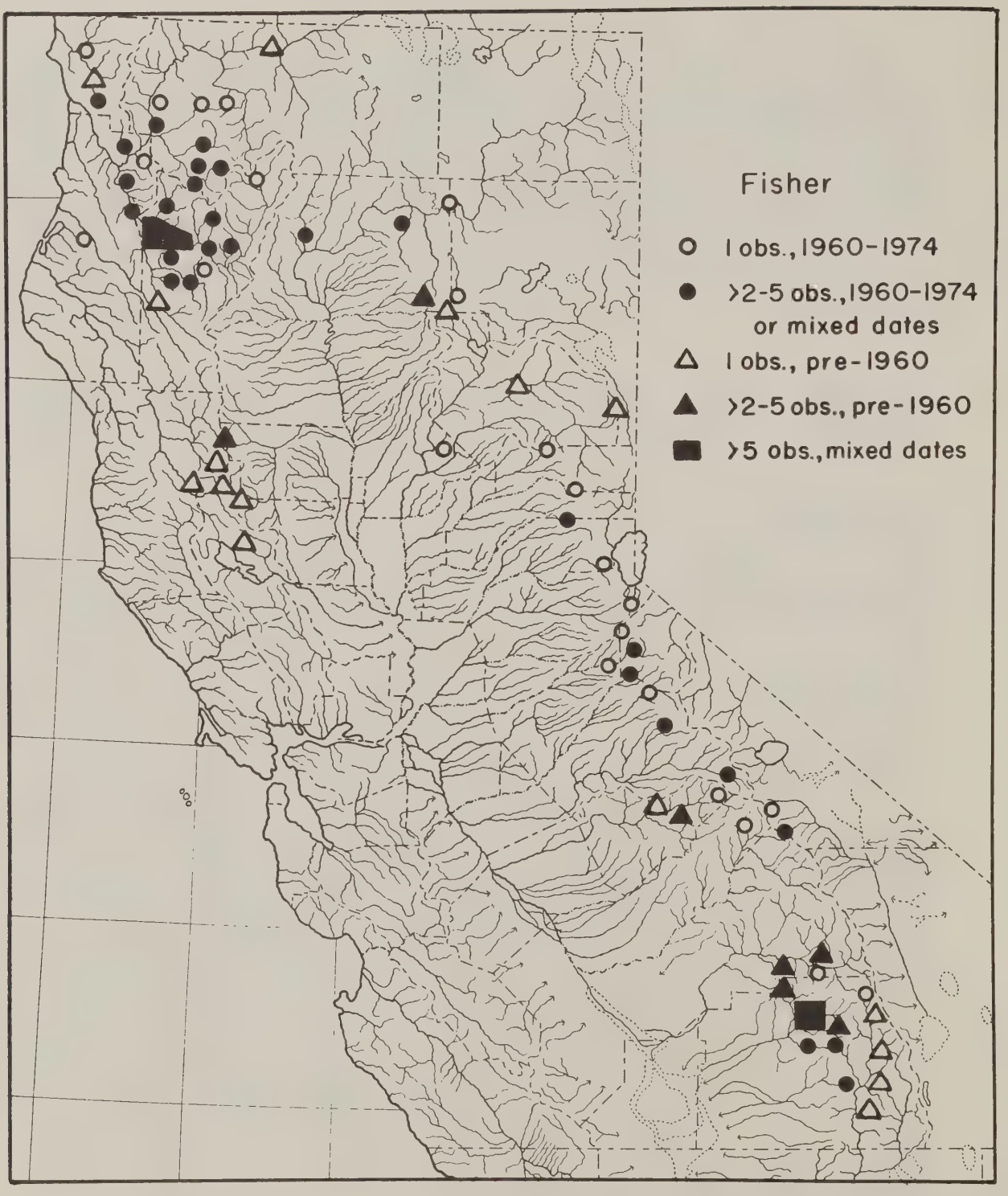

Figure 8. Distribution of fisher reports.

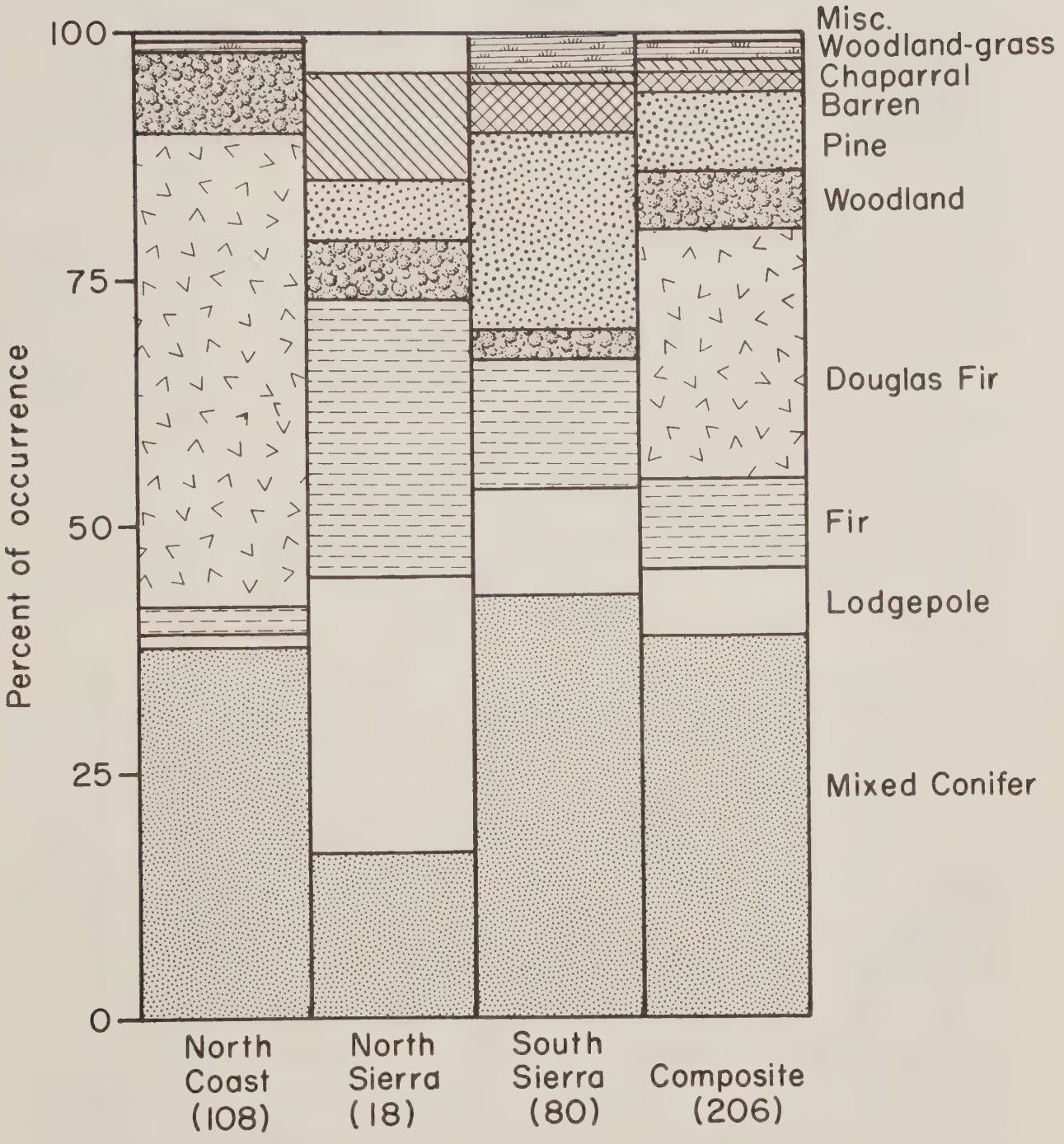

Figure 9. Percent occurrence of fisher reports by vegetation type in three regions of California. Sample size in parentheses.

The elevational distribution determined for the fisher during this study was slightly lower in the North Coast Region and slightly higher in the South Sierra than indicated by the literature (fig. 10). In the North Coast Region, most of the sightings were between 1,600 and 4,800 feet, while in the South Sierra they fell mainly between 4,800 and 8,800 feet. The average elevations for the sightings from the North Coast, North Sierra and South Sierra Regions were 3,200, 5,500 and 6,800 feet, respectively. The lowest record was 300 feet near Weitchpec, Humboldt County, and the highest was 11,400 feet at Lake Virginia, Mono County.

North Coast Region

The information collected from the North Coast does not indicate any obvious departure from the distribution shown by Grinnell et al. (1937). Most of the sightings gathered for this region came from northern Trinity and southwestern Siskiyou counties and the adjacent part of Humboldt County (fig. 8). This area currently sustains the densest population of fishers in California. The reports collected by Grinnell et al. (1937) appear to be grouped in central Trinity County. The current data may reflect a shift of the population towards the more rugged country to the north.

Other parts of the North Coast Region appear to support only moderate or low fisher populations. M. Lewis suspects fishers to be only transient in the Covelo area and they are listed as rare on the Mendocino National Forest (USFS 1972). Fishers are listed as rare in Redwood National Park (Leach 1973), although no evidence has been obtained to prove their presence (Eley 1973). Fishers are also believed to be uncommon in the Cottonwood Peak area of north-central Siskiyou County (M. Ryce).

North Sierra Region

Only 18 records were found for fishers in the North Sierra. Grinnell et al. (1937) also indicate very few capture locations in this region. Grinnell et al. (1930) stated that fishers were occasionally trapped west of Eagle Lake, but no record of this was shown on the map of the 1937 publication.

Two records occur outside of the previously delineated range of Grinnell et al. (1937). J. Foster trapped a fisher in 1943 in the Diamond Mountains of extreme eastern Plumas County. The vegetation of this area is mixed conifer and the average elevation is 6,500 feet, which falls within the habitat presumably preferred by fishers in California. It is likely that fishers still occur in this area. Another was seen southeast of Pittville, Lassen County, at 3,500 feet in the juniper type (V. Cunningham). The occurrence of fishers in this type of habitat is unusual and it is unlikely that they are resident in this part of Lassen County.

The consensus is that fishers are rare throughout the North Sierra Region. They are believed to be absent in the Mount Shasta area (B. Benkosky) and in Modoc National Forest (M. Carmichael, T. Scofield, and R. Ward). Fishers were listed as rare for Lassen Volcanic National Park in 1971 (Clemons 1971), and were not even mentioned in two subsequent reports (Ringgold 1972, Schneider 1973). They are believed to be either rare or absent on the Plumas National Forest by personnel of the Forest Service and California Department of Fish and Game. The only conflict of opinion is in the Yuba Summit–Webber Lake area of Sierra County. L. Johnson of Sierraville reported that he doubted that fishers were present in this area. H. Moeglin of Loyalton, however, believes fishers are increasing in this area. Investigation is in order.

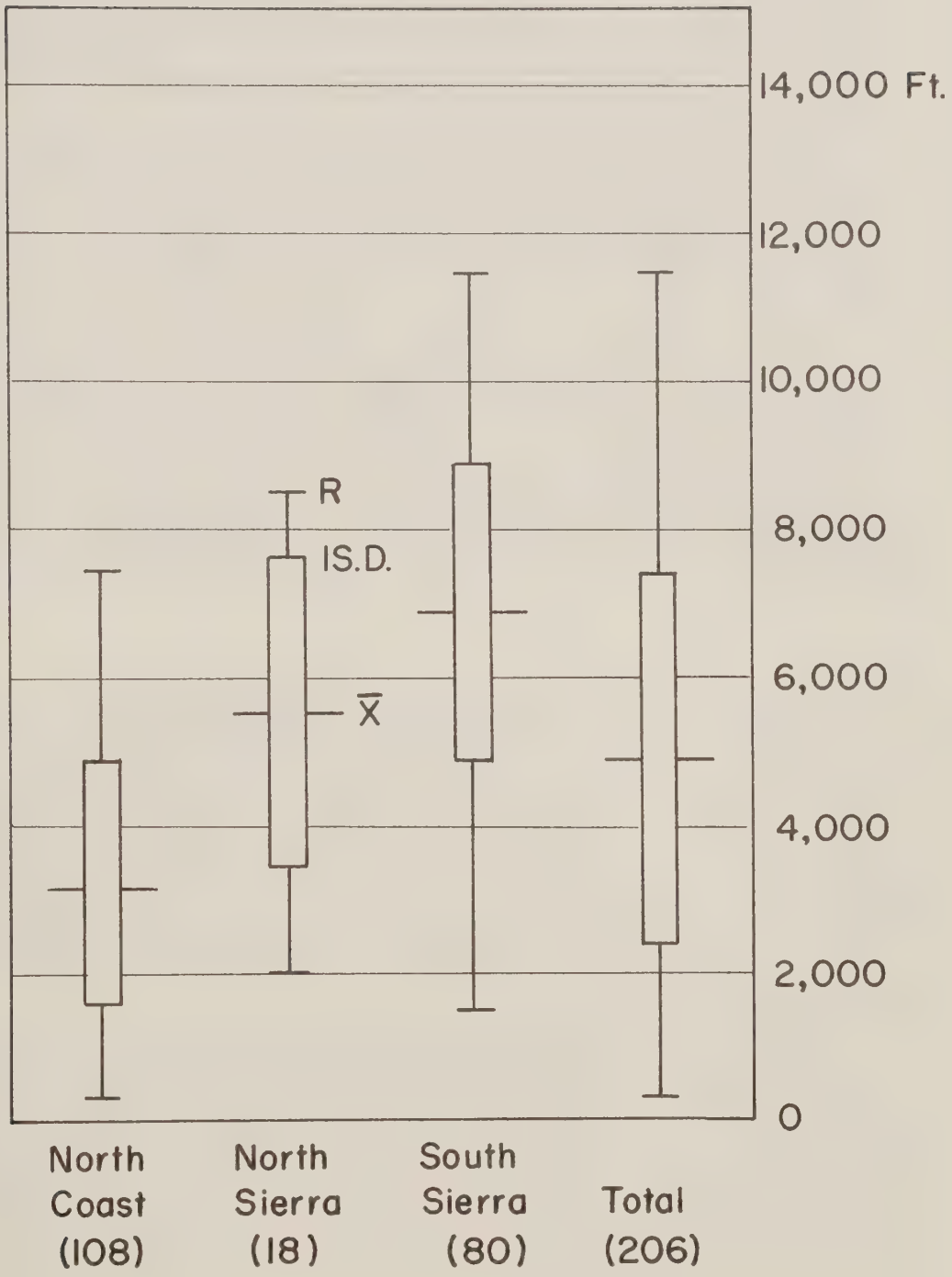

Figure 10. Elevational distribution of fisher reports in three regions of California. Sample size in parentheses.

South Sierra Region

The South Sierra Region contained 39% of our 208 fisher records. The majority of these were obtained from eastern Tulare County and the adjacent part of Fresno County south of the Kings River. Previous writers have stated that Tulare County has traditionally been a good area for fishers (Ingles 1965, Seymour 1968). They also indicate, however, that Tuolumne County was a favored area. Fishers now are listed as rare for Yosemite National Park (Sansum 1973), and only 5 records for Tuolumne County were discovered compared to the 53 sightings from Tulare County.

The distribution of sightings collected in the South Sierra compares favorably with the distribution shown for this area by Grinnell et al. (1937), with one possible exception. B. Douglas stated that, in 1955, he saw fisher tracks along Bodfish Creek, 3 to 4 miles out of Lake Isabella in Kern County. This location could not be accurately located, so it was not placed on the map (fig. 8). This is the only record we found of fishers south of the Kern River.

Over most of the South Sierra Region the fisher apparently is uncommon or rare. Orr (1949) indicated fishers to be extremely rare in the Lake Tahoe region. B. Evans of Gardnerville, Nevada, stated that he has never encountered fishers or their signs south of Lake Tahoe on the east slope of the Sierra. The few records obtained indicate that fishers are indeed rare east of the Sierra crest. The assembled information shows that they are somewhat more plentiful on the west slope of the Sierra, but by no means are fishers common north of the Kings River. The principal areas of fisher abundance for the South Sierra are the Converse Basin area, Fresno County, and the upper reaches of the Kaweah and Kern River drainages in Tulare County.

Trends

Trends in the fisher population of Trinity County are well documented. In the early part of this century, 20 to 25 fishers were trapped annually in the Trinity National Forest, an area roughly equivalent to Trinity County. Fishers were believed to be becoming rare (Jotter 1918). J. McKnight of Weaverville suggested that there was a population decline in the 1920's or 1930's. A. Nunn of Big Bar stated more specifically that during the winter of 1926-27, many fishers were caught in Trinity County. After this exceptionally successful trapping, fishers disappeared until the early 1960's. A. Nunn and J. McKnight believe fishers to be common and increasing at the present time. All data indicate that fishers now are common and increasing in numbers in Trinity and possibly southwestern Siskiyou and northeastern Humboldt counties.

The few records from the North Sierra do not allow an accurate assessment of trends. It appears, however, that a population is persisting at a very low density.

Although 80 records were found for fishers in the South Sierra Region, it appears that their numbers are decreasing. Of the records available for Yosemite and Sequoia-Kings Canyon National Parks, only 31% and 38%, respectively, of these sightings have been made since 1950 (Schempf and White 1974). As previously mentioned, casual observations are not a sound basis for trend estimation, but they do indicate that the fisher populations of California need study urgently.

WOLVERINE

The original description of the wolverine's range in California indicated that it was found from the vicinity of Mount Shasta to Monache Meadows in Tulare County (Grinnell 1913). However, in later publications the primary distribution was believed to be in the central and southern Sierra from Lake Tahoe through Tulare County (Grinnell 1933, Grinnell et al. 1937). Contemporary authors continued to reiterate this description of the wolverine's range despite accumulating evidence indicating that this species could be found over a wider area (Ingles 1965, Seymour 1968). Wolverines were reported in the North Coast counties as early as 1855 (Grinnell et al. 1937), but it was not until 1959 that this area was acknowledged in the literature as being part of the wolvèrine's actual range (Hall and Kelson 1959). The reluctance of authors to broaden the drawn distribution lines is attributed to the few specimens collected in northwestern California. The number of reports of wolverines and their signs in the North Coast and North Sierra Regions now leaves no doubt of their presence in these areas. (fig. 11).

The range indicated by Hall and Kelson (1959) can be considered to indicate the pristine distribution of the wolverine in California. No wolverines have been recorded in the coastal counties south of the 40th parallel for many years. From a composite of the current literature, it appears that the wolverine's range presently extends from Del Norte and Trinity counties (Yocom 1973) eastward through Siskiyou and Shasta counties (Wildlife Management Institute 1974) and then southward through the Sierra to Tulare County (Jones 1950, 1955b).

Vegetation types

Published reports place the customary haunts of wolverines in the semi-open country at or above timber line (Grinnell 1933, Sumner and Dixon 1953). They reside chiefly in the Subalpine Forest and Alpine Fell-fields of Munz and Keck (1949, 1950) near timber line and above (Ingles 1965). There are no published reports of the type of habitat used in northern California.

Sixty-five percent of the 17 reports of wolverine received for the North Coast Region fell in the Douglas-fir type (fig. 12). The remaining 35% were in the mixed conifer type. It is likely that the wolverine also occurs in the fir and lodgepole types situated in the higher parts of the North Coast Region. There are no observations to support this conclusion, however.

Mixed conifer is also important in the North Sierra; 8 of 16 records occurred in this type. Four more records came from the lodgepole type and 3 came from the fir type.

In the South Sierra, lodgepole pine was the most important type. It contained 40% of the 110 records from this region. Barrens were second most important with 24% of the records. Mixed conifer and fir were third and fourth, respectively.

Records from the South Sierra Region corroborate the habitat description found in the literature, but data from the other two regions do not. The reason for this departure from the expected habitat types in northern California is uncertain. Perhaps it is a result of an inadequate number of observations available for the northern regions.

The only verbal report on the habitat of wolverines came from H. Schimpke of Sonora. He told us that in the vicinity of Lake Alpine, Alpine County, wolverines had been observed in association with lodgepole, red fir and scattered junipers. This concurs with the description given in the literature and with the vegetation determined for this area.

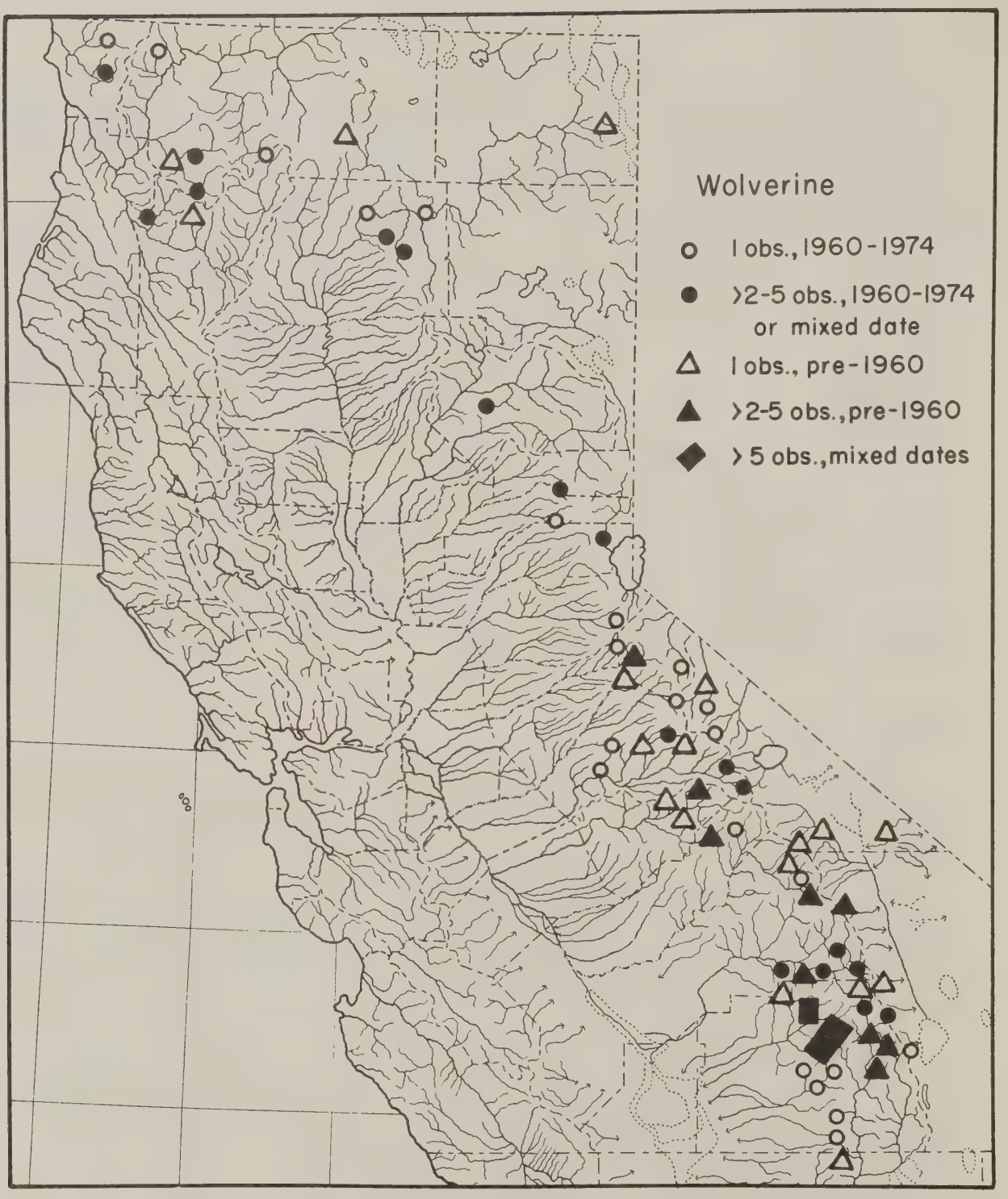

Figure 11. Distribution of wolverine reports.

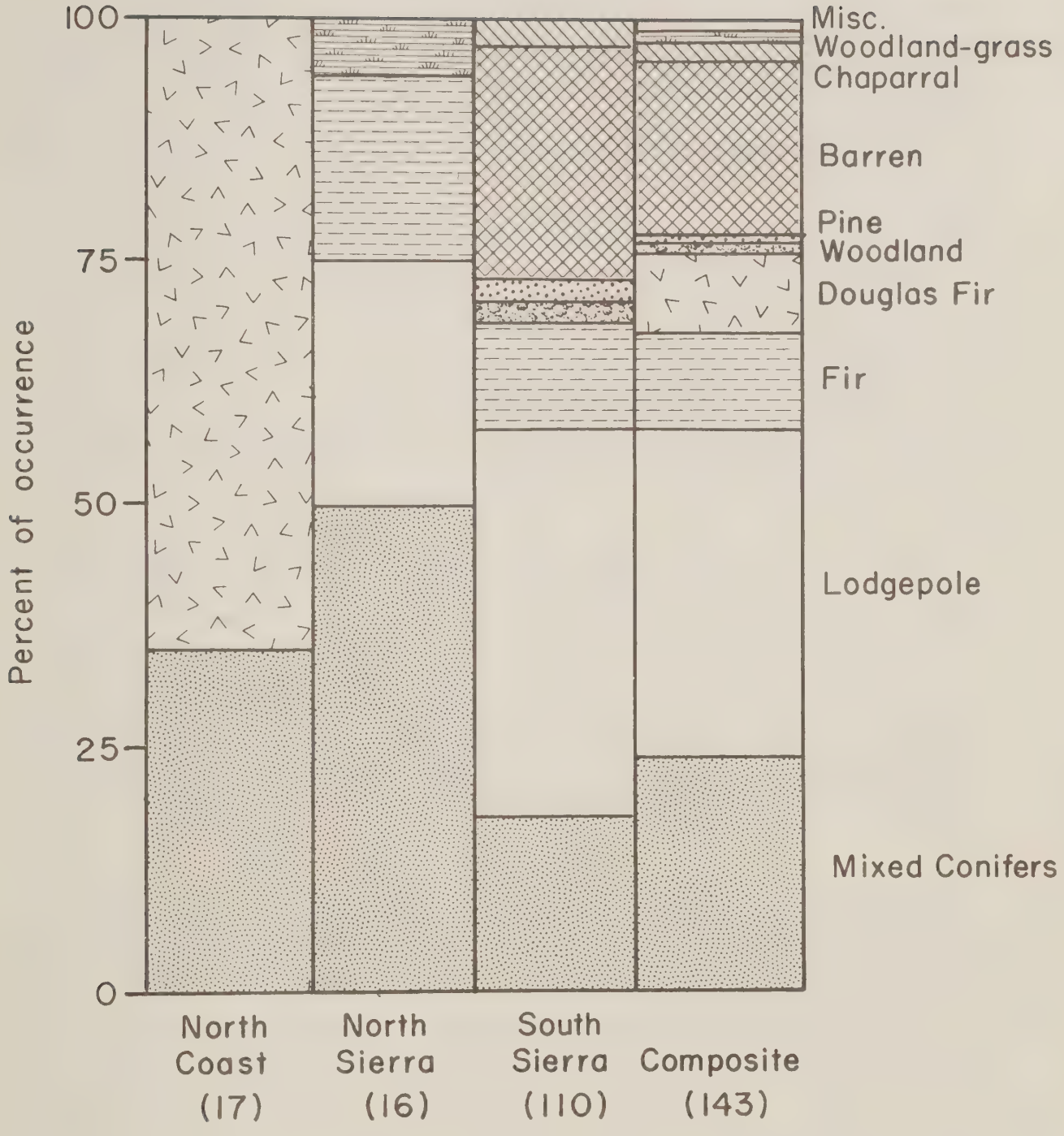

Figure 12. Percent occurrence of wolverine reports by vegetation type in three regions of California. Sample size in parentheses.

Elevational distribution

The lowest previously recorded observation of the wolverine was 5,000 feet at Camp Nelson, Tulare County, while the highest record came from Mount Lyell in Yosemite National Park at an elevation of 13,000 feet (Grinnell et al. 1937). Most writers put the majority of wolverines above 8,000 feet (Grinnell 1933, Storer and Usinger 1963), but Fry (1923) is more liberal and places their range between 6,500 and 13,000 feet. All of these estimates are based entirely on wolverine observations in the South Sierra.

The 17 records from the North Coast Region suggest that the average elevation of occurrence for the wolverine in this area is 2,800 feet with most records lying between 1,600 and 4,800 feet (fig. 13). The lowest record was 1,300 feet at the Forks of the Salmon, Siskiyou County, and the highest was 5,000 feet on Ship Mountain, Del Norte County. Although there are sizeable areas above 5,000 feet in elevation, especially in Siskiyou and northern Trinity counties, there are no records which exceed this elevation. Perhaps the remoteness of these higher areas and the sparseness of wolverine populations make an encounter between a wolverine and one of the few humans that penetrate the higher parts of the North Coast Region unlikely. Investigations are in order.

The wolverine population of the North Sierra is found approximately between 4,300 and 7,300 feet with 5,800 feet being the average. The lowest occurrence was at 3,000 feet near Big Bend in Shasta County. One was reportedly shot in this vicinity during the winter of 1972-73. The highest observation was 7,800 feet at the Signal Peak Lookout in Nevada County.

The data collected from the South Sierra show that the wolverine occurs mostly between 6,400 and 10,800 feet, which compares favorably with the limits set down by Fry (1923). The low record was 2,800 feet at the powerhouse on the Tule River, Tulare County. G. Franklin (CDFG) of Porterville said that one was found dead in the river, presumably drowned. While it is probable that this animal washed down the river from some higher point, the second lowest record was at only 3,100 feet along the Generals Highway near Hospital Rock in Sequoia National Park (Sumner and Dixon 1953:328). It is apparent that, at times, the wolverine does travel through areas well below its usual range. The highest record for the South Sierra Region was that of Jones (1950) on White Mountain Peak, Mono County, which reaches to 14,200 feet.

North Coast Region

We found 17 records for wolverines in the North Coast Region. All of the observations except one were distributed from Del Norte County through western Siskiyou County and into the northern part of Trinity County (fig. 11). This general area encompasses the higher parts of the North Coast Region.

The southernmost record was found in Mendocino County. M. Lewis of Covelo saw a wolverine in the Hearst area during the 1930's, but he doubts that they are currently present in Mendocino County. A. Nunn believes that the Big Bar area in northern Trinity County represents marginal wolverine habitat. From the lack of current records it appears that the present wolverine range in the North Coast Region does not extend much farther south than the Trinity River.

The number of wolverines in the North Coast Region is low. They are believed to be rare in the Sawyers Bar area (M. Ryce), the center of the North Coast wolverine distribution. While wolverines never attain a dense population, a comparison with the South Sierra records indicates that wolverines are especially sparse in northwestern California. This is presumably attributable to the limited amount of satisfactory habitat.

North Sierra Region

We found 16 widely scattered reports of wolverines in the higher parts of the North Sierra Region. Only one old record was found for eastern Siskiyou County. This was an observation made in 1925 by O. H. Allred just east of Mount Shasta (G. Zamzow). Likewise, there was only one report for Modoc County. V. Cunningham stated that he saw photographs of a wolverine trapped by W. Royce in 1928 in the Warner Mountains. This was one of the few reports obtained on the furbearers in the relatively unknown Warners. There have been no recent reports of wolverines in Modoc County (M. Carmichael, T. Scofield, R. Ward).

In Shasta County, 6 records were acquired primarily due to the efforts of CDFG personnel. All reports were made in the northeastern part of the county with most records centered about Burney Mountain. Oddly enough, there were no reports from Lassen Volcanic National Park in southeastern Shasta County, an area that one would expect wolverines to inhabit.

Two recent reports were procured from the vicinity of Meadow Valley, Plumas County, and 3 more were recorded from the Webber Lake area of Sierra County. A wolverine was reported at the Signal Peak Lookout in southern Sierra County and 3 other sightings were made in Placer County. One of the sightings from Placer County has been previously reported (Ruth 1954), but the other 2 are more recent. During the summer of 1973, a wolverine was observed on several occasions near Martis Creek. It is uncertain whether it was the same individual each time.

As in the North Coast Region, the small number of sightings reported for the North Sierra implies that this population is sparser than that of the South Sierra.

South Sierra Region

One hundred ten records were collected from the South Sierra Region. They fall within the distribution shown by Grinnell et al. (1937) in all areas except in Mono and Kern counties. Several of the records from Mono County were on the margins of the indicated distribution, and the sighting listed by Jones (1950) on White Mountain is decidedly farther east than any previous records. T. Wenzel has also observed wolverines in the White Mountains at McAfee Meadows. It appears that from this information wolverines can be expected to occur in the eastern parts of Mono County.

An observation to the south of the given range of the wolverine was recorded by Jones (1955b). He stated that one was observed on the west side of Greenhorn Mountain, Kern County, at an altitude of 5,000 feet. Grinnell et al. (1937) list one record in the Piute Mountains of Kern County, but they believed this individual to be a stray from the higher Sierra to the north. The observation on Greenhorn Mountain may also represent a stray animal from farther north, but it is feasible that this may be the southern margin of the wolverine range. The wolverine population of the South Sierra is the densest in the state, but the animal still must be considered uncommon.

Trends

Lacking an historical perspective, it is difficult to assess trends in the northern part of the state. The available sightings, however, suggest that wolverine numbers are increasing in the North Coast and North Sierra Regions (Table 2).

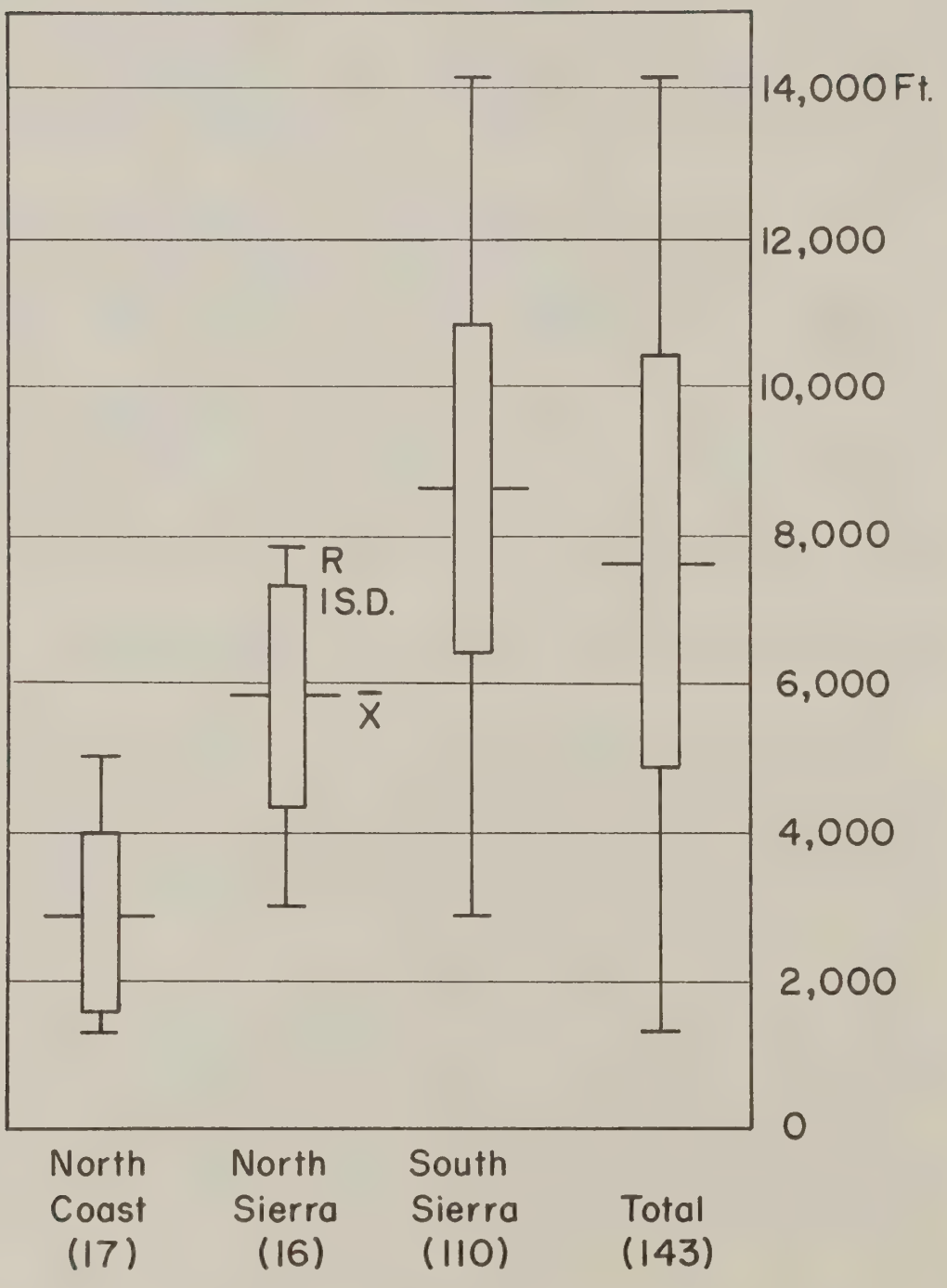

Figure 13. Elevational distribution of wolverine reports in three regions of California. Sample size in parentheses.

Table 2
Number of wolverine reports in three regions of California in four time periods.

Region	Time Period				
	Pre-1950	1950-1959	1960-1969	1970-1974	Total
North Coast	1	3	3	9	17[a]
North Sierra	1	1	4	10	16
South Sierra	54	16	22	18	110
Total	56	20	29	27	143

[a] One undated record.

The records from the South Sierra show a more moderate increase in the number of sightings; however, it appears that by the end of the present decade, the number of sightings in the South Sierra for the 1970's will exceed the number recorded for the 1960's.

The evidence of trends given above should be viewed with a discriminating eye. Whether this rise in the number of observations denotes an increase in actual numbers, or an increase in some other factor or factors such as interest or number of observers, cannot definitely be determined. A thorough field study of the actual distribution and densities of the wolverine in California is needed.

RIVER OTTER

Otters are found throughout the well-watered parts of northern California (fig. 14). They are primarily freshwater creatures, but otters have been noted in salt marshes and other marine locations (Longhurst 1940, Ingles 1965). They have been observed in the Sacramento, San Joaquin and North Coast drainages (Grinnell 1914, Seymour 1968). The reported distribution in northern California extends eastward from the coast to the Sierra crest and to the Warner Mountains of Modoc County. In the south, otters occur primarily between the San Joaquin River and the Sierra crest (Grinnell et al. 1937). Only one observation of river otters in the coastal mountains south of San Francisco Bay has been made (Morejohn 1969). It is doubtful that they are established in this area. The center of abundance for this species is in the Sacramento—San Joaquin Delta (Grinnell et al. 1937).

Vegetation types

The literature does not mention any close association between otters and a particular vegetation type. This is not surprising considering its habits. The otter is by nature a creature of the water and is relatively independent of the vegetation occurring beyond the riparian zone. Otters seem to occur wherever there is a plentiful food supply, sufficient water, and vegetation to provide shelter and foraging areas (Bailey 1936, Sumner and Dixon 1953).

Otter distribution is not correlated with the distribution of any one particular vegetation type (fig. 15). Mixed conifer was the preferred type in the North Coast, pine was favored in the North Sierra, and lodgepole predominated in the South Sierra. The statewide figures show a broad representation in forest types, particularly in the mixed conifer areas. The otter is not closely associated with dry regions which favor chaparral, nor is the otter associated with the relatively sterile environment of the alpine barrens. The large miscellaneous category noted for the North Sierra otters represents cultivated land (19%) and grasslands (11%).

Elevational distribution

Otters in California reportedly occur from sea level to at least 9,000 feet (Grinnell et al. 1937), where one was observed in Babcock Lake, Yosemite National Park (Russell 1928). Otters are believed to most frequently inhabit the lower and middle altitudes where food is more abundant (Sumner and Dixon 1953). They are, however, able to exist over a wide range of elevations (Bailey 1936). The otters of the North Coast Region are usually found at the lower elevations, presumably due to the greater abundance of food and water (fig. 16). Seventy-three records show that most otters occur between 800 and 2,000 feet. They have been observed from near sea level in the Klamath River up to 3,800 feet near Signal Peak (Mount Lassic) in Humboldt County.

The adaptability of the otter to a wide range of elevations is suggested by the large standard deviations noted in the observations from the North and South Sierra regions. The sightings were not concentrated about the average elevation, but were scattered over a broad elevational range of more than 5,000 feet in each case. In the North Sierra, otters were evenly distributed from the Sacramento River at an elevation of about 50 feet up to Twin Lake in Lassen Volcanic National Park at an elevation of 6,600 feet. In the South Sierra, otters were found over a range of 10,000 feet from 900 feet at the confluence of the north and south forks of the Tuolumne River up to 10,900 feet at Kuna Lake in Yosemite.

The majority of records from the North Sierra Region fell between 600 and 6,000 feet,

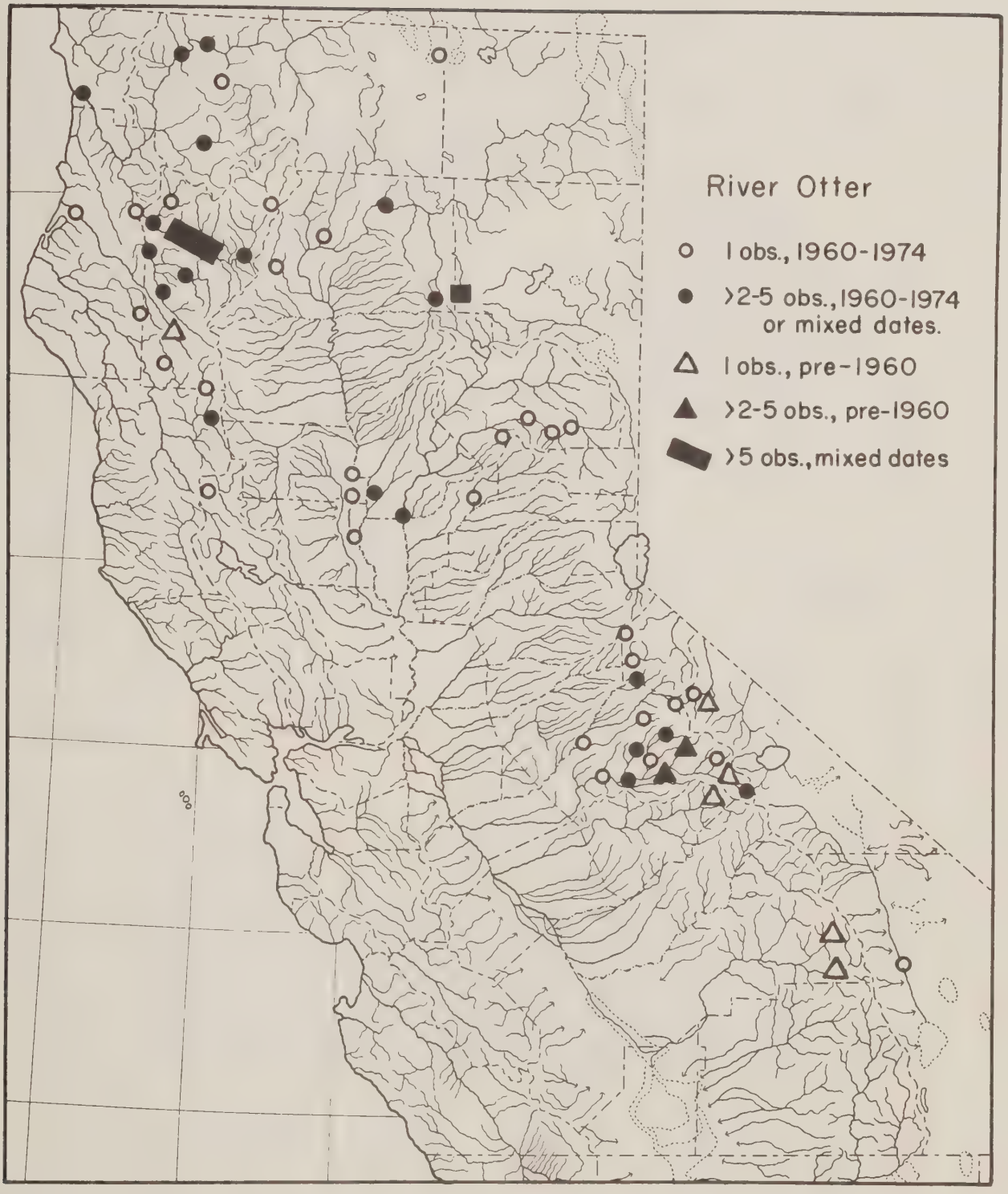

Figure 14. Distribution of river otter reports. Data for the Central Valley are incomplete. See Kirk (1975) for the results of a recent survey conducted by California Department of Fish and Game.

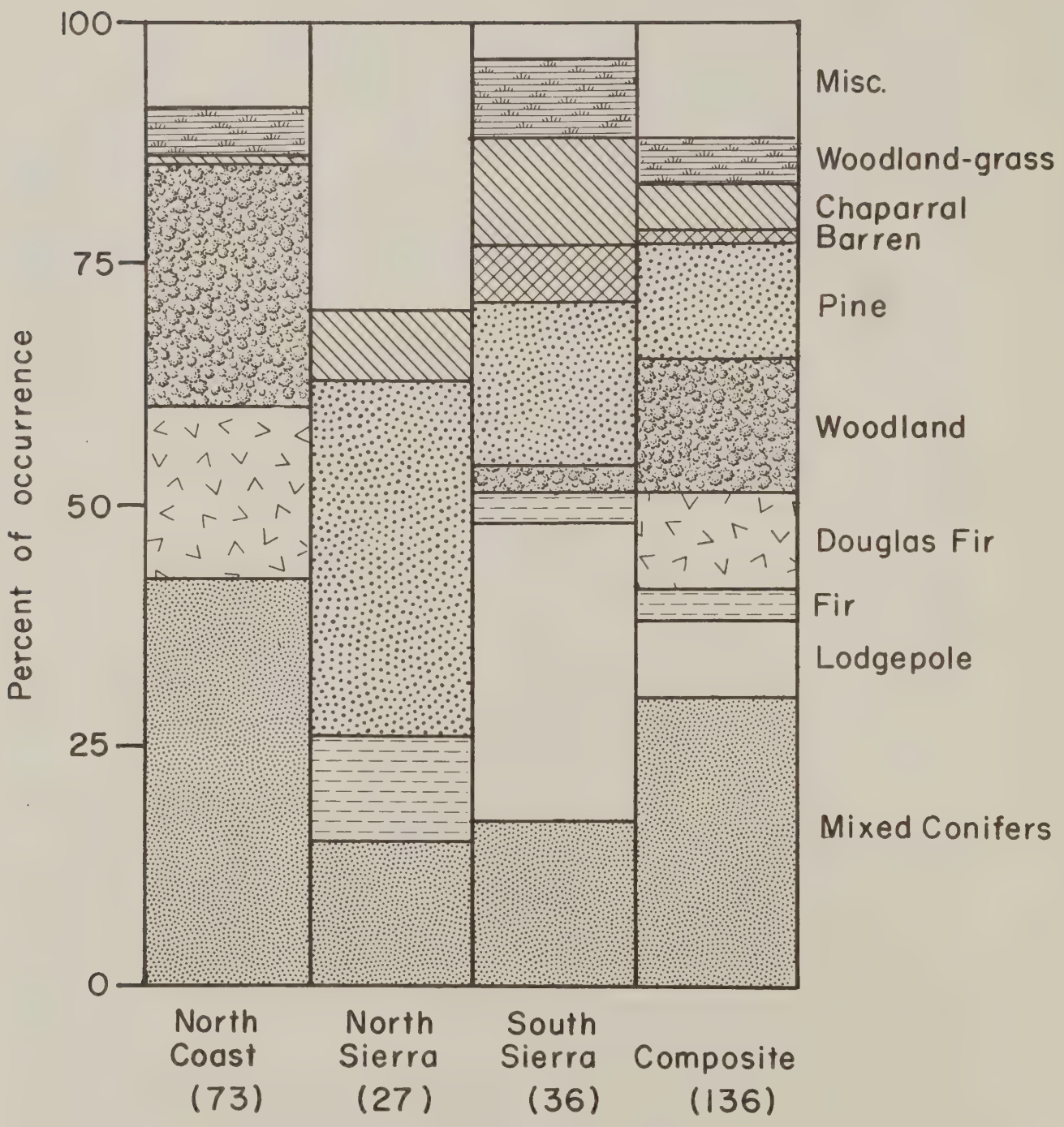

Figure 15. Percent occurrence of river otter reports by vegetation type in three regions of California. Sample size in parentheses.

while most South Sierra Region records came form 3,300 up to 8,900 feet. This large change in elevation is caused perhaps by a change in habitat from the North to the South. In the North, otters live primarily in the rivers and larger streams of the Sacramento drainage. The South Sierra has fewer large drainages, but more lakes in the higher elevations. The otters of the South Sierra are more likely to be found in these lakes than the small streams of the lower elevations.

North Coast Region

Fifty-four percent of the 136 collected records came from the North Coast Region, and most of these came from the Trinity River (fig. 14). This is mainly a result of the large number of records amassed at the Big Bar Ranger Station, but it is possible that the Trinity is an exceptionally good otter river. Records show that otters occur throughout the Klamath–Trinity River drainage, at least from its mouth on the coast (Redwood NP records) up to Copco Dam on the Klamath (M. Ryce), and to the north end of Lake Trinity on the Trinity River (FS records). No records were obtained for the Smith River in Del Norte County, but otters probably occur there. Grinnell et al. (1937) show several records for that drainage.

Farther south, otters have been recorded in the Mad River and in the Eel–Van Dusen River system. In 1965, 3 trappers took 34 otters from the Eel River during a 3-week period (H. Humphrey). The southern-most record was from Lake Pillsbury in Lake County.

It can be assumed that otters occur commonly over the entire North Coast Region. From the collected observations, it appears that the Klamath–Trinity River drainage is currently supporting the densest otter population of all the areas studied. Another area in the state that apparently has comparable densities of river otters is the Sacramento River drainage. See Kirk (1975) for the results of a new survey.

North Sierra Region

Otters occur generally throughout the Sacramento River drainage wherever there is sufficient water. They are rare in most of Siskiyou County, with reports only from the Klamath River (M. Ryce) and Tule Lake (P. Hixson). Although the assumed distribution of otters encompasses the major part of Modoc County (Grinnell et al. 1937), we found no records here. The Pit River drains most of this county, but no records were found on the Pit above the vicinity of Fall River Mills in Shasta County. Otters are currently believed to be absent from most of Modoc County (M. Carmichael, T. Scofield, R. Ward).

In Shasta County, the Pit River supports a good otter population, according to local trappers (B. Childs, F. Terry, D. Ruff, and V. Cunningham). Otters are also well established in Clear Creek, the Sacramento River southward from Mount Shasta, the McCloud River and in many smaller tributaries of these larger drainages. They have been observed in the lakes of Lassen Volcanic National Park, but they are uncommon (Schempf and White 1974).

Otters are not so common in the drainages farther south. They occur throughout the Feather and Yuba river drainages, but not in large numbers. Grinnell et al. (1937) also found a concentration of reports in Shasta County and only scattered records farther south.

South Sierra Region

Most of the records for otters in the South Sierra Region came from lakes in Tuolumne County. Reports were also found from Tuolumne and Clavey rivers and from lakes in Alpine County. These areas all fall within the previously described distribution (Grinnell et al. 1937).

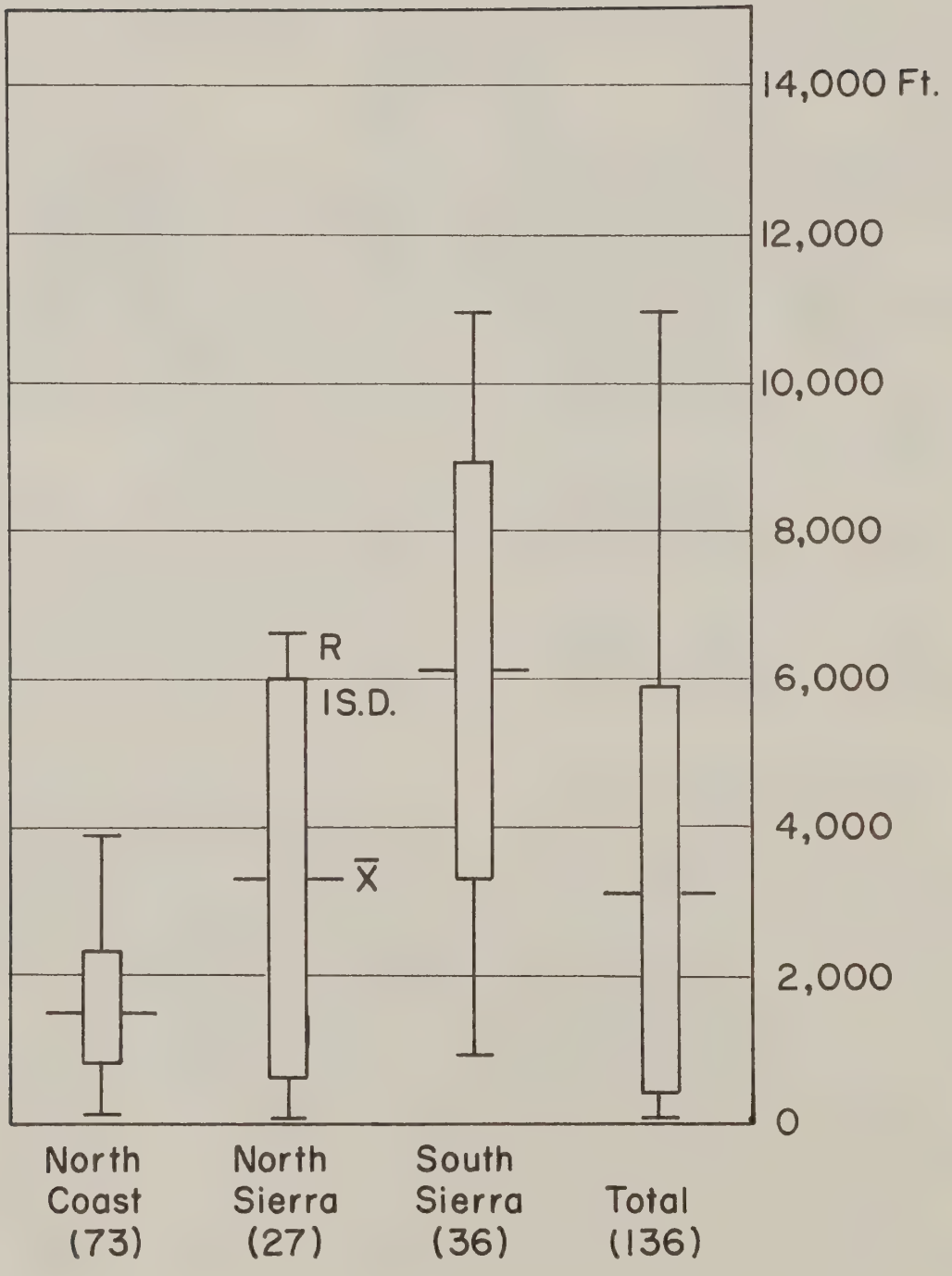

Figure 16. Elevational distribution of river otter reports in three regions of California. Sample size in parentheses.

The otter was not shown to occur east of the Sierra crest by Grinnell et al. (1937); however, there now are several reports of otters in Mono and Inyo counties. The first was at Poore Lake in Mono County where 5 otters were observed on 11 August 1954 (Laughlin 1955). G. Price saw one in a small lake east of Sonora Pass in 1963. Otters have also been reported infrequently in Robinson and Buckeye creeks and the West Walker River (M. Hysell, M. Applegate).

The records from Mono County are only a short distance from the margin of the otter's distribution assumed by Grinnell et al. (1937), so it is quite possible that an occasional otter would be found in the northern Mono County drainages. The record from Inyo County, though, is far removed from any previous reports. R. Patterson, a qualified observer, has noted otter signs along the Owens River near Independence on two occasions, once in 1968 and again in 1973. These reports are unusual and need confirmation.

No recent reports were obtained south of the Tuolumne River. Grinnell et al. (1937) listed only a few reports south of the Tuolumne with the last observations made in 1926. The most recent report of otters found in Sequoia-Kings Canyon National Park was from 1910 (Sumner and Dixon 1953). This lack of reports indicates that the otter is presently rare, if not absent, in the Sierra south of the Tuolumne River.

Even in Tuolumne County, the presumed center of the South Sierra population, otters are not found in large numbers. They are listed as rare in Yosemite National Park (Sansum 1973). Generally, otters are uncommon in Tuolumne and Alpine counties and rare over the rest of the South Sierra Region where they occur.

Trends

Otters appear to be generally increasing throughout California. Conversations with local residents indicate that otters are increasing in the Klamath River (M. Ryce) and in the Trinity River (A. Nunn, J. McKnight). They are also believed to be increasing in the Pit River in Shasta County (V. Cunningham). T. Wion stated that he first noticed otter signs in the Millville vicinity of Shasta County in 1971 and now signs are abundant. Table 3 shows that half of the recorded observations have been made in the last 4 years.

Table 3
Number of river otter reports in three regions of California in four time periods.

	Time period				
Region	Pre-1950	1950-1959	1960-1969	1970-1974	Total
North Coast	1	0	24	45	73[a]
North Sierra	0	0	16	11	27
South Sierra	6	4	9	12	36[b]
Total	7	4	49	68	136

[a] 3 undated reports

[b] 5 undated reports

Allowance must be made for the probability that the most recent records are the easiest to find, but the paucity of records prior to 1960, compared to the uniform increase since then, strongly suggests a statewide increase in otter numbers.

The results of a new survey of river otter distribution in northern California, conducted by the Department of Fish and Game, support our appraisal of a recent increase in numbers. This report (Kirk 1975) became available as our paper was being prepared for publication. It shows additional locations of otter sightings throughout northern California, particularly in the Sacramento River drainage, extending downstream into the Sacramento–San Joaquin River Delta. This Sacramento Valley area was not covered adequately by our surveys.

RED FOX

The native red fox is the least well known furbearer in California. It is also perhaps the rarest, rivaled only by the wolverine. It inhabits the higher elevations of California and was traditionally found in greatest numbers in the areas around Mount Shasta and Lassen Peak, in the Sierra west of Mono Lake and in the vicinity of Mount Whitney (Grinnell et al. 1937).

Red foxes also occur on the floor of the Sacramento Valley (fig. 17), and in some other lowland areas of California. They were first noted in the latter half of the 19th century in the vicinity of Sutter Buttes. Whether these foxes are native or introduced has not been determined, but it has been suggested that they were introduced (Grinnell et al. 1937). Until recently these foxes had been recorded in the literature from Colusa, Glenn, Tehama, Sutter and Butte counties. A new survey, conducted by the Department of Fish and Game (Gray 1975, 1977) indicates that observations have increased markedly in recent years, and that the range has expanded.

Most of the records collected during our study are from the Sierra population. There are several records, however, from the floor of the Sacramento Valley and the mountains farther west. In our presentation, these two groups of records are segregated because of the unknown systematic status of the valley population. Likewise, in the text, the discussion of the sierran records will be separated from the records from the Sacramento Valley and coastal mountains. Except where specified otherwise, the discussion will apply only to the red foxes found in the mountains, to *V. f. necator.*

Vegetation types

The literature shows that the red fox is found in the red fir, lodgepole, sub-alpine forests, and the alpine fell-fields which are situated in the higher elevations of the Sierra Nevada (Ingles 1965). This fox prefers open areas while hunting, such as above timber line (Grinnell et al. 1937), open grassy parks and meadows (Bailey 1936), and open forest stands (Seton 1937). In general, the red fox ranges over large tracts of land and occurs almost everywhere within its elevational range (Grinnell et al. 1937). The red fox observations occur in vegetation types in a manner similar to the marten and wolverine (fig. 18). In the North Sierra Region, most records occurred in the fir and mixed conifer types. Records in pine and lodgepole were almost as frequent. In the South Sierra, most sightings fell within the mixed conifer type, but the importance of this type may be exaggerated. There were 5 records of red fox from Yosemite Valley, 4 of which were recorded in a 2-month period in 1964. It is likely that these observations were of the same fox or foxes. The continual presence of many observers in the valley almost ensures the reporting of any unusual occurrences. A plentiful food supply in close proximity to the usual habitat of the red fox makes it likely that an occasional red fox will be observed in the valley. Lodgepole pine and fir, as noted in the North, were also important in the South Sierra Region.

Elevational distribution

The Sierra red fox lives chiefly above 7,000 feet and seldom ventures below 5,000 feet. One instance is recorded when one was observed at 4,500 feet near Bucks Meadows, Tuolumne County. The highest observation was made on Cirque Peak near Mount Whitney at an elevation of 11,500 feet (Grinnell et al. 1937).

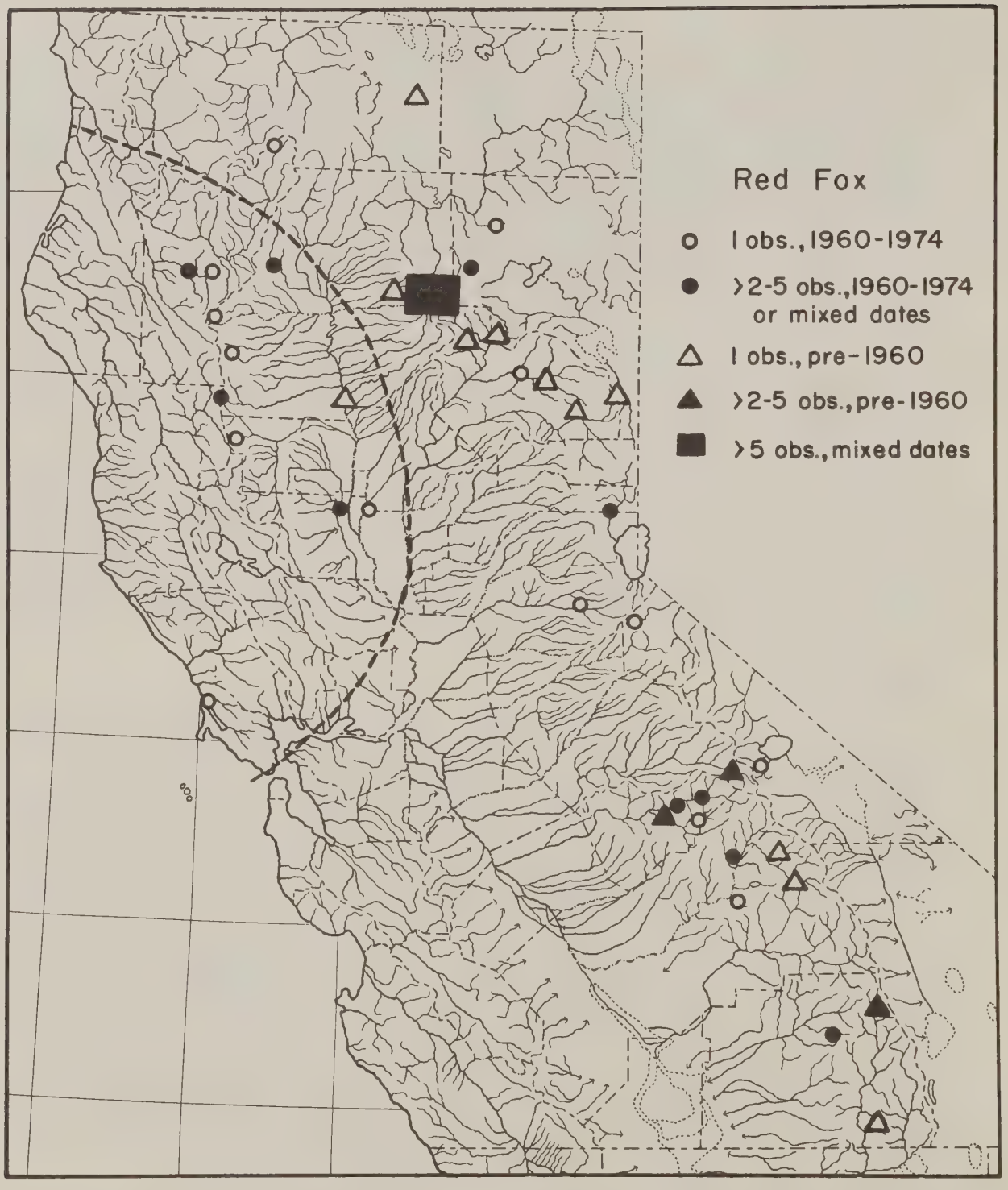

Figure 17. Distribution of red fox reports. Dashed line separates Sierra population from that of uncertain taxonomic status in the Central Valley. Data for the Central Valley are incomplete. See Gray (1975, 1977) for the results of a recent survey conducted by the Department of Fish and Game.

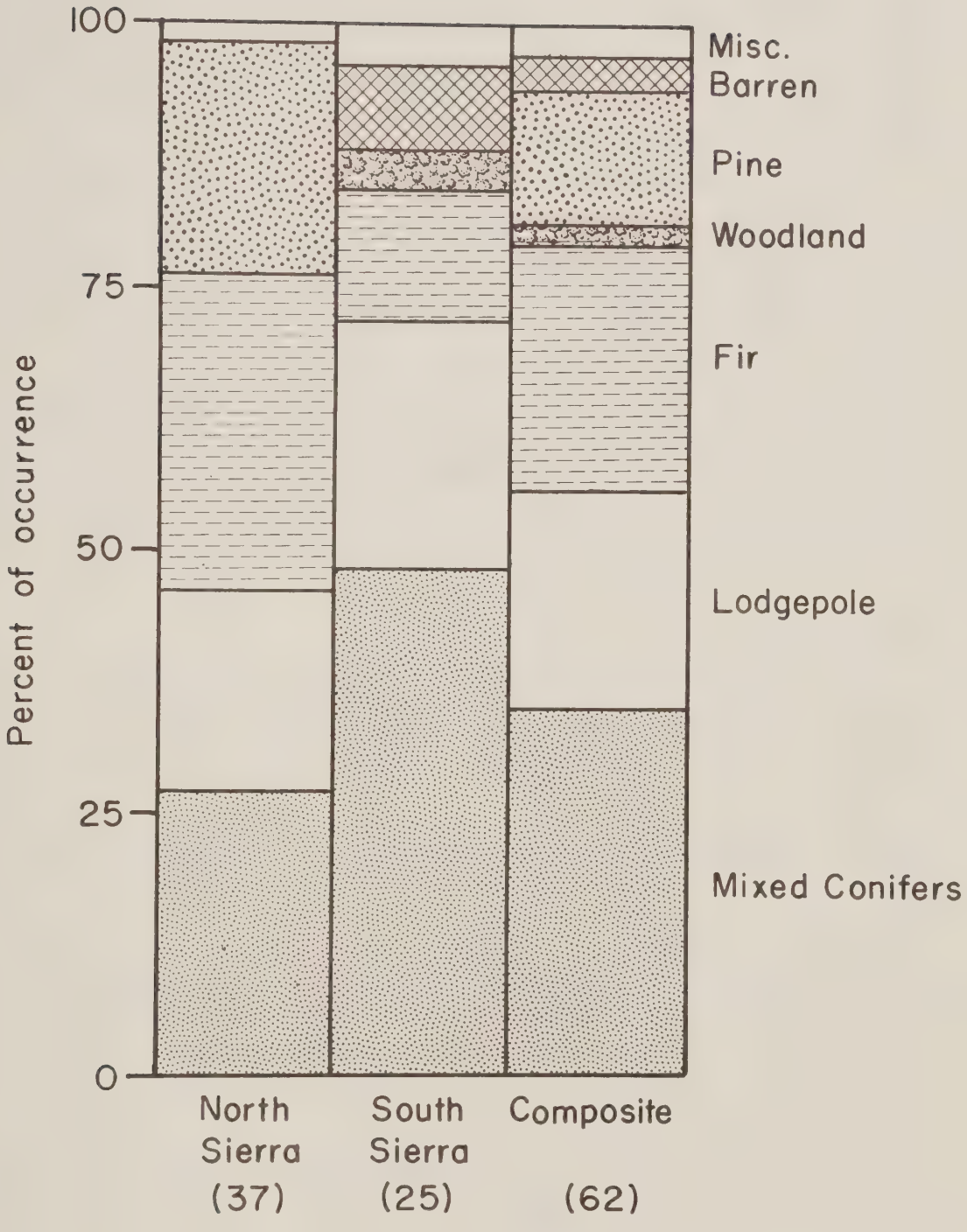

Figure 18. Percent occurrence of red fox reports by vegetation type in two regions of California. Sample size in parentheses.

The records obtained suggest that most red foxes in the North Sierra Region occur between 5,400 and 7,400 feet with 6,400 feet being the average (fig. 19). The highest observation was at 8,500 feet on the south side of Lassen Peak and the lowest was at 4,300 feet 2 miles west of Viola, Shasta County. In the South Sierra, the records ranged from a low of 3,900 feet in Yosemite Valley to a high of 11,900 feet at Lake South America. The average elevation of the reports was 6,900 feet with most records lying between 4,500 and 9,300 feet.

A comparison of the average elevation of red fox occurrences in the North and South Sierra regions reveals an interesting difference from all other species surveyed. The differences between the average regional elevations within each species were highly significant using Tukey's w procedure (Sokal and Rohlf 1969:238) except for the red fox. This could be partially attributed to the smaller number of reports obtained for the red fox, but perhaps it is the result of the observations in Yosemite Valley noted above. If the 5 Yosemite Valley sightings are eliminated, the average elevation for the South Sierra changes from 6,900 to 7,600 feet and the standard deviation decreases from 2,400 to 2,100 feet. The difference between averages for the North and South increases correspondingly, and instead of not being significant, the difference is highly significant. The latter range of figure (7,600 ± 2,100 ft.) more accurately estimates the natural elevational distribution of the red fox in the South Sierra. It also agrees more closely with the elevation distribution described in the literature and with the pattern of regional variation noted for the other species.

North Sierra Region

The distribution of records (fig. 17) shows that the red fox occurs over a more continuous range than suggested by Grinnell et al.(1937). Two foxes were collected at Medicine Lake near the Siskiyou–Modoc County line, but these records were very old. Another report came from Cory Peak near the northern tip of Trinity County, but it was not confirmed (P. Friday).

There was one report of red foxes in the Warner Mountains of Modoc County (R. Ward). It was reported that a possible red fox was sighted on upper Bucher Creek, but this record could not be verified. Presumably suitable habitat is available in the Warners, but red foxes have not previously been recorded.

The largest concentration of sightings in California was noted in the vicinity of Lassen Volcanic National Park. More than a third of all of the collected records came from this area. The Lassen Peak area traditionally has been noted for red fox (Grinnell et al. 1937), and it presently supports the densest population of Sierra red fox in California.

Most of the records found in Plumas County were outside of the previously indicated range of the red fox. Red foxes ranged over most of the county at one time, but the lack of current records makes the present status uncertain.

Several records were obtained from Nevada County, and there were several verbal reports of red fox in central Sierra County (H. Moeglin, L. Johnson). These records fall within the previously described distribution.

South Sierra Region

Grinnell et al. (1937) show the red fox to occur from Lake Tahoe southward through the higher elevation of the Sierra and well into Tulare County. All of the records collected during this study fell in the presumed range except for the southernmost record. B. Douglas stated that he trapped 4 red foxes near Big Meadow and Serretta Peak in the 1920's. This indicates that at one time this area was within the range of the red fox. Whether or not they

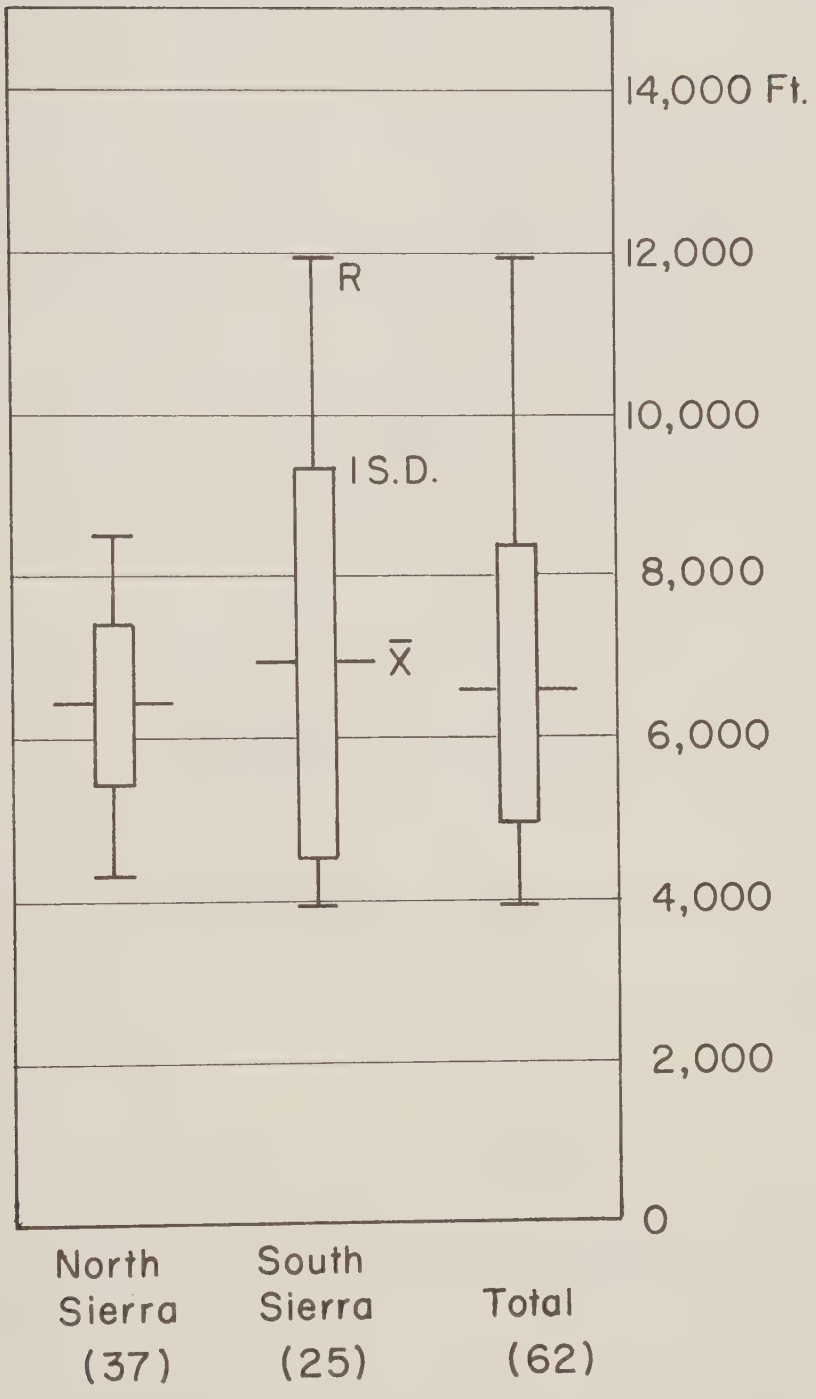

Figure 19. Elevational distribution of red fox reports in two regions of California. Sample size in parentheses.

still occur in this area is unknown.

The rest of the records are centered near the headwaters of the Kern and Kaweah rivers and in the vicinity of Yosemite National Park. These concentrations may be the result of the protection afforded the foxes by the National Parks which encompass these areas.

Trends

Of all the species studied, the red fox is the only one for which the data do not suggest a population increase. There are 19 records from the 1950's, 19 from the 1960's and 12 from the 1970's. From all indications, the red fox populations of the Sierra are maintaining themselves at a low level, or perhaps declining. This is assuming that the number of sightings is a true indicator of population trends. If it is supposed that current records are more available and that there are more observers afield in recent years than previously, it is more likely that red fox populations actually are decreasing.

No matter how the data are manipulated, the few records obtained, and the temporal distribution of these records, indicate that the Sierra red fox is in a more precarious position than any of the other 5 species surveyed. Although scarcity makes field studies of the red fox difficult, a thorough inventory and subsequent conservation measures should be undertaken to assure the continued existence of the red fox in the mountains of California.

Red fox populations of unknown status

Grinnell et al. (1937) documented the presence of a population of red foxes in the upper Sacramento Valley and stated that they had little information about it. The taxonomic status of the valley foxes has never been determined. It is possible that this population, and other red foxes observed in lowland areas of California, originated from introductions or from release or escape of pets. Vail (1942), for example, reported that in 1942 there were approximately 125 fox farms in California, raising about 20,000 animals for fur.

We found the following records: T. Stone reported that 3 red foxes were collected recently in the Butte Sink. Three reports from Colusa County also have been confirmed with 2 specimens collected and one reliable observation. One specimen has also been obtained from Tehama County. All of these locations are within the limits estimated for this population by Grinnell et al. (1937). The only other positive report was a red fox at Dillon Beach in Marin County. This animal was shot and is currently in the Museum of Vertebrate Zoology. It is possible, however, that this specimen was a domestically raised fox that had escaped or had been released. The rest of the records are suspect. Many of these sightings probably represent gray foxes *(Urocyon cinereoargenteus),* which are common in the foothills west of the Sacramento Valley. It is possible, however, that red foxes have spread westward into the coast range. This cannot be assumed, though, until further evidence has been obtained. A thorough investigation of the systematic status and distribution of these populations is needed.

Subsequent to our efforts, the California Department of Fish and Game conducted a search for records of the red fox in the Sacramento Valley, including interviews with trappers. The results indicate that these valley foxes are increasing in numbers and extending their range to the north, south, and west. They have been observed in Shasta, Trinity, Tehama, Butte, Colusa, Glenn, Sutter, Yuba, Yolo, Napa, Solano, El Dorado, and San Joaquin counties (Gray 1975, 1977).

CONCLUSIONS

The results of this study are summarized in Table 4. Vegetation types with 25% or more of the sightings per region are listed in order, with the highest percentage listed first. Elevations are indicated as the average and standard deviation in feet. The total figures for each species are weighted towards the region which contributed the largest number of sightings. An example of this is the river otter which, although uncommon in the Sierra Nevada, is considered common overall because of the dense populations occurring in the North Coast Region.

Although a large amount of information was collected during this study, there is still a great need for further work on these furbearers. The results of this paper should be regarded as tentative conclusions until more thorough field investigations confirm and expand them. Until the completion of such investigations, however, the results of this study can form the basis for management decisions over large areas of California.

These data require conclusions of a general and tentative nature. The data have several shortcomings, which should be noted. Ideally, the observations should have been correctly identified, accurately recorded, and kept with some type of continuity over the years. Unfortunately, this was not the case in many areas. Some errors in identification were obvious and could be sorted out, but others were not and could only be regarded with suspicion. Occasionally the records were fragmentary, lacking the specific date or location of the observation. These reports were treated as accurately as possible within the constraints of the time and supplemental information available.

Uniform effort in recording observations over the years would have allowed a reasonably accurate estimate of population trends, but the efforts in most areas were sporadic at best. These faults do not negate the value of the data, but they should be taken into consideration.

Land managers in California today need more specific information. The impact of land uses, such as logging, recreation, or development needs to be evaluated and reasonable recommendations need to be formulated. The quality and quantity of habitat needed for these furbearers must be determined so suitable areas can be maintained and managed for their benefit.

All of the species surveyed need further study, but certain priorities seem in order:

1. Red fox
2. Wolverine
3. Fisher
4. Otter
5. Marten
6. Ringtail

These species are rated primarily by their rarity, but they are also considered from a research standpoint. Information on the red fox is critical, and priority should be given to the Sierra population. The reports indicate that the Sierra red fox is at best maintaining itself at a very low density. In order to ensure the continued presence of this race of red fox, its true status and needs should be determined.

The wolverine is second because of its rarity and also as a result of the apparent recent increase in numbers. A thorough survey should be conducted to accurately determine current distribution and to determine relative population densities.

The current status of the fisher population in Trinity County presents an ideal situation for research on this species. The density of this population is at a high point and offers a good opportunity to obtain information on this usually sparsely distributed mammal.

Table 4
Summary of the furbearer survey.

Species	Region	Number of records	Most important vegetation types	Average elevation ± 1 S.D.	Status	Trends
Ringtail	North Coast	37	Woodland	1900 ± 900	Common	Increasing
	North Sierra	31	Mixed conifer	2800 ± 1600	Common	Increasing
	South Sierra	79	Woodland, Mixed conifer	3900 ± 1700	Common	Increasing
	Composite	147	Woodland	3200 ± 1700	Common	Increasing
Marten	North Coast	34	Mixed conifer, Douglas Fir	4700 ± 1900	Uncommon	Increasing
	North Sierra	189	Fir, Lodgepole	6600 ± 1600	Common	Increasing
	South Sierra	171	Lodgepole	8300 ± 1500	Common	Increasing
	Composite	394	Fir, Lodgepole	7200 ± 1800	Common	Increasing
Fisher	North Coast	108	Douglas Fir, Mixed conifer	3200 ± 1600	Common	Increasing
	North Sierra	18	Fir, Lodgepole	5500 ± 2100	Rare	Static
	South Sierra	80	Mixed conifer	6800 ± 2000	Uncommon	Decreasing
	Composite	206	Mixed conifer, Douglas Fir	4800 ± 2500	Uncommon	Increasing
Wolverine	North Coast	17	Doulgas Fir, Mixed conifer	2800 ± 1200	Rare	Increasing
	North Sierra	16	Mixed conifer, lodgepole	5800 ± 1500	Rare	Increasing
	South Sierra	110	Lodgepole	8600 ± 2200	Uncommon	Increasing
	Composite	143	Lodgepole	7600 ± 2800	Uncommon	Increasing
River Otter	North Coast	73	Mixed conifer, woodland	1500 ± 700	Common	Increasing
	North Sierra	27	Pine	3300 ± 2700	Uncommon	Increasing
	South Sierra	36	Lodgepole	6100 ± 2800	Uncommon	Increasing
	Composite	136	Mixed conifer	3100 ± 2700	Common	Increasing
Red Fox	North Sierra	37	Fir, Mixed conifer	6400 ± 1600	Rare	Static, decreasing
	South Sierra	25	Mixed conifer, lodgepole	6900 ± 2400	Rare	Static, decreasing
	Composite	62	Mixed conifer	6600 ± 5100	Rare	Static, decreasing

There is a need for more data on river otter populations of the state. This survey did not adequately cover all parts of California inhabited by the otter. River otters are currently being taken accidentally while trappers legally seek beaver and other aquatic furbearers. Many trappers suggest that a limited season be established for river otters so that otters taken accidentally can be utilized. Before such measures are implemented, a thorough investigation should be made of the actual numbers of otters present, their potential to withstand limited trapping, and the prevalence of accidental trapping.

Marten and ringtail populations are larger; neither population is threatened in California. They would be the least difficult species to study in the field. The most suitable areas for studies would be the Lassen Peak area for marten and the North Fork Feather River Canyon for ringtail. The likelihood of livetrapping large numbers of animals for study is good.

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